DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-1257

TO 16-30URM48-5

~~I-15~~

I-5

PARTIAL Reproduction
$15.00

SIGNAL GENERATOR AN/URM-48

SG-12

SG 12A in rear

DA-69

Missing

68 ohm

3/4 + 3/4 + 3 3/4

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

DECEMBER 1953

20 19.9 - 20.1

28 27.86 - 28.14

27 26.865 - 27.135

39 38.805 - 39.195

38 37.81 - 38.19

55 54.725 - 55.275

47 46.765 - 47.235

69 68.655 - 69.345

67 66.665 - 67.335

102 101.49 - 102.51

TM 11-1257
TO 33A1-8-18-1
Changes No. 1

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *1 April 1955*

TM 11-1257/TO 16-30URM48-5, 8 December 1953, is changed as follows:

62. Test Equipment Required for Troubleshooting and Testing

(Superseded)

The test equipment required for troubleshooting and testing of Signal Generator SG-12/U is listed below. Available technical manuals associated with the test equipment also are listed.

Test equipment	Publication
Multimeter TS-352/U	TM 11-5527
Crystal Rectifier Test Set TS-268(*)/U	TM 11-1242
Frequency Calibrator-Meter Set AN/URM-18.	Instruction book with equipment
Audio Oscillator TS-382A/U	TM 11-2684A
Panoramic Indicator IP-173/U	
Spectrum Analyzer TS-723/U	
Signal Generator TS-497A/URR	TM 11-5030
Voltmeter ME-30A/U	
Electron Tube Test Set TV-2/U	
Resistance Bridge ZM-4B/U	TM 11-2019
Oscilloscope OS-8A/U	TM 11-1214

80. Setting RF ATTENUATOR MICROVOLTS Stops

* * * * *

b. Use the procedure given below to set the stops.

* * * * *

(3) Connect a sensitive r-f voltmeter in place of the r-f cable head **with a 50-ohm resistor across it.**

* * * * *

81. Test Equipment Required for Alinement

* * * * *

b. A-C Electronic Voltmeter. The modulation frequency deviation is determined by the signal amplitude of the audio stages. An electronic type a-c voltmeter such as **Voltmeter ME-30A/U** or equivalent is satisfactory for a-f voltage measurements.

* * * * *

86. R-F Output Adjustment

a. When the r-f attenuator is set to 10K (10,000 μv), the output voltage at the end of the r-f-cable without the cable head must be 50 millivolts. When setting the r-f oscillator output for the 50-millivolt potential, three conditions must be fulfilled: the r-f attenuator (RF ATTENUATOR MICROVOLTS) must be exactly 10K; the RF SET TO LINE meter must be set to the line; and there must be 50 millivolts across the output cable with the r-f cable head disconnected **and the head substituted by a 50-ohm resistor.** Use the following procedure:

* * * * *

87. Deviation Level and Distortion Adjustments

a. The signal generator * * * the following manner:

* * * * *

(2) Connect a sensitive a-c vtvm such as **Voltmeter ME-30A/U** at the output of V9.

* * * * *

88. Minimum Noise Adjustments

* * * * *

b. Refer to figures 41 and 42 for the location of potentiometer R107. Use the following procedure for adjustment of potentiometer R107.

(1) Connect the r-f output cable to the low noise f-m receiver antenna terminals. Connect a sensitive a-c vtvm across the audio output of the f-m receiver. **The** vtvm should be **Voltmeter ME-30A/U** or its equivalent.

* * * * *

92. Test Equipment Required for Final Testing

The instruments needed for testing the repaired equipment are listed below, and are listed by nomenclature in paragraph 62.

a. A-C Electronic Voltmeter. It is necessary

to measure audio voltages in the signal generator while setting the modulation levels. An a-c vtvm is necessary to provide accurate measurements. **Voltmeter ME–30A/U** or equivalent is satisfactory for these measurements.

* * * * *

97. R-F Output Test

a. (Superseded) Remove the r-f cable head and in its place connect a 50-ohm resistor between plug P2 and ground. Connect a sensitive r-f output voltmeter across the resistor.

* * * * *

99. Modulation Distortion Test

a. The equipment required for measuring the modulation distortion in the f-m output of the SG–12/U consists of Spectrum Analyzer TS–723/U; **a low distortion audio amplifier (Electronic Multimeter ME–6A/U can be used);** and an f-m receiver having an r-f range of 20 to 100 mc, a minimum bandwidth of 100 kc, and a discriminator with a linear range from —100 kc to +100 kc.

* * * * *

100. Noise Test

a. To make the noise test, it is necessary to use a low noise f-m receiver and a sensitive a-c vtvm such as **Voltmeter ME–30A/U.** The receiver need not cover all the r-f frequencies of the signal generator since the test only has to be made at one frequency which may be chosen at random.

* * * * *

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Rescinded

[AG 412.41 (8 Mar 55)]

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

M. B. RIDGWAY,
General, United States Army,
Chief of Staff.

OFFICIAL:
JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

N. F. TWINING,
Chief of Staff, United States Air Force,

OFFICIAL:
E. E. TORO,
Colonel, United States Air Force,
Air Adjutant General.

DISTRIBUTION:

Active Army:

Tec Svc, DA (1)
Tec Svc Bd (1)
CONARC (5)
CONARC Bd (Incl ea Test Sec) (1)
Army AA Comd (2)
OS Maj Comd (5)
OS Base Comd (5)
Log Comd (5)
MDW (1)
Armies (5)
Corps (2)
Tng Div (2)
Ft & Cp (2)
USMA (5)
Gen & Br Svc Sch (5)
SigC Sch (25)
Gen Depots (2)
SigC Sec, Gen Depots (10)
SigC Depots (20)
POE (2)
OS Sup Agencies (2)
SigC Fld Maint Shops (3)
SigC Lab (5)
Mil Dist (1)
Units organized under following TOE's:
11–7, Sig Co Inf Div (2)
11–16A, Hq & Hq Co. Sig Bn, Corps or Abn Corps (2)
Units organized under following TOE's—Continued
11–57, Armd Sig Co (2)
11–127, Sig Rep Co (2)
11–128A, Sig Depot Co (2)
11–500A (AA–AE), Sig Svc Org (2)
11–557A, Abn Sig Co (2)
11–587A, Sig Base Maint Co (2)
11–592A, Hq & Hq Co, Sig Base Depot (2)
11–597A, Sig Base Depot Co (2)

NG: Same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see SR 320–50–1.

☆ ☆U.S. GOVERNMENT PRINTING OFFICE: 1968—342-012/1476

C-2

DEPARTMENT OF THE ARMY TECHNICAL MANUAL
DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

SIGNAL GENERATOR AN/URM–48

TM 11–1257
TO 33A1–8–18–1
CHANGES No. 2

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *2 August 1956*

TM 11–1257/TO 33A1–8–18–1, 8 December 1953, is changed as follows:

Change "Signal Generator SG–12/U" to **Signal Generator SG–12(*)** in the following places in the manual:

Page 7, paragraph 3. Line 1.
Page 7, paragraph 3. Line 13.
Page 9, figure 3. Caption and block.
Page 10, paragraph 8. Heading.
Page 10, paragraph 8*a*. Line 1.
Page 10, paragraph 8*c*. Line 12.
Page 11, paragraph 11. Line 2.
Page 15, figure 5. Caption.
Page 17, figure 6. Caption and callout.
Page 25, paragraph 26. Line 1.
Page 31, figure 13. Caption.
Page 38, paragraph 46. Line 1.
Page 39, figure 16. Caption.
Page 60, paragraph 62. Line 2.
Page 62, figure 31. Caption.
Page 65, figure 32. Caption.
Page 80, figure 41. Caption.
Page 82, paragraph 91. Line 3.
Page 83, paragraph 98. Line 2.
Page 84, paragraph 98. Line 6.
Page 84, paragraph 98*a*(2). Line 1.
Page 84, paragraph 98*a*(5). Line 1.
Page 84, paragraph 98*a*(7). Line 4.
Page 84, figure 44. Block.
Page 85, paragraph 99*a*. Line 3.
Page 85, paragraph 99*b*(2). Line 1.
Page 85, figure 45. Block.

Page 7, paragraph 1. Add the following after the first sentence:

Signal Generator AN/URM–48 consists of Signal Generator SG–12/U or Signal Generator SG–12A/U carried in Signal Generator Case CY–1217/U accompanied by Electrical Dummy Load DA–69/URM–48. Signal Generator SG–12(*) is used to refer to Signal Generator SG–12/U and Signal Generator SG–12A/U.

Page 7, paragraph 1. Delete *a* and *b*.

Page 9, paragraph 5. Delete the information given under "Frequency range:" and substitute the following:

Frequency range:	*SG–12/U*	*SG–12A/U*
Rf:		
	Band A 19.5 mc. to 29 mc.	20 mc. to 28 mc.
	Band B 26.5 mc. to 39.5 mc.	27 mc. to 39 mc.
	Band C 37 mc. to 56 mc.	38 mc. to 55 mc.
	Band D 46 mc. to 70 mc.	47 mc. to 69 mc.
	Band E 66 mc. to 102 mc.	67 mc. to 102 mc.
If	1.4 mc.	1.37 mc.
	2.515 mc.	1.40 mc.
	2.65 mc.	1.43 mc.
	2.88 mc.	4.27 mc.
	4.3 mc.	4.30 mc.
	4.45 mc.	4.33 mc.
	5.00 mc.	4.45 mc.
	5.35 mc.	5.00 mc.
	15.0 mc.	5.35 mc.
	Two spare positions for future use.	15.00 mc.
		One spare position for future use.

Page 9, paragraph 5. Delete "Weight" and the associated information and substitute the following:

Weight:

	Signal Generator SG–12/U	*Signal Generator SG–12A/U*
In dust cover only	72 lbs	65 lbs
In transit case	104 lbs	97 lbs

Page 10, paragraph 7. Delete the table of components and substitute the following:

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu. ft.)	Unit weight (lb.)
Signal Generator SG–12/U	1	12	12	18	1.5	72
or						
Signal Generator SG–12A/U	1	13½	12	18	1.7	65
Case CY–1217/U	1	16⅝	15⅝	21⅝	3.2	32
Electrical Dummy Load DA–69/URM–48	1	¾	¾	3¼	----------	----------
Technical Manual TM 11–1257	2	10⅛	¼	7⅞	----------	0.5
Total (SG–12/U)						105
Total (SG–12A/U)						98

Page 11, paragraph 10.

Add "Signal Generator SG–12/U" as a heading over the list of running spares given.

Change the item "1 tube, type 6AQ5" to read: **1 tube, type 6AK6.**

Add the following column.

Signal Generator SG–12A/U

1 tube, type 0A2.
1 tube, type 5Y3WGTA.
2 tubes, type 6AH6.
1 tube, type 6AK6.
1 tube, type 6C4W.
1 tube, type 6J6W.
1 tube, type 12AU7.
1 resistor, thermal; Amperite 9–4.
5 fuses, 1-ampere.
1 lamp 120-volt, 3-watt.
1 lamp, neon.
1 lamp, 6-volt, 0.2-ampere.
1 lamp, 6-volt, 0.15-ampere.

Page 12, paragraph 12.

d. (Added) Signal Generator SG–12A/U has a different set of crystals to provide more commonly used of output signals to equipments under test. In addition, 10 crystal frequencies are provided with one spare position instead of the nine frequencies with two spares provided in SG–12/U. Ruggedized versions of tubes V6, V9, V10, V12, and V13 are used. A 1N21C crystal replaces the 1N21B used in the rf voltage metering circuit in previous models and potentiometers R60, R61, and R62 in the modulator of output stage are changed to JAN standard 25,000-ohm type. Resistor R25 has been eliminated from the grid circuit of modulator V5 and resistor R24 has been increased to 6,800 ohms to make up for the deletion. Resistors R47 (plate load of tube V8) and R48 (B+ decoupling) have been changed to 2 watts and IF. LEVEL potentiometer R91 to 4 watts. Capacitors C70 through C76 have been added to the circuit.

Page 15, figure 5.

NOTE (Added): IN SIGNAL GENERATOR SG–12A/U:
V6 IS TUBE TYPE 6J6W
V9, V12, AND V13 ARE TUBE TYPE 6C4W
V10 IS TUBE TYPE 5Y3WGTA.

Page 15, paragraph 15. **Caution:** Change "(fig. 7)" to read: **(figs. 7 and 7.1).**

Page 16, paragraph 16*c.* Delete the first three sentences in (1) and substitute the following:

(1) The if. cable is used when an if. signal is to be supplied to the mixer or if. amplifier of a receiver. With Signal Generator SG–12/U, the if. signal may be applied directly across a grid resistor, or through a blocking capacitor when used with circuits above ground or containing B+ voltages. In Signal Generator SG–12A/U, blocking capacitor C70 forms an integral part of the if. cable termination. Termination impedance in both SG–12/U and SG–12A/U is 25 ohms.

Page 18, paragraph 19.

Change "(fig. 7)" to read: **(figs. 7 and 7.1).** Change the function of the IF. FREQUENCY MC Switch (S8) to read as in the chart below:

Control	Function
IF. FREQUENCY MC switch (S8).	Selects the proper crystals and tuning circuits to provide the desired output frequencies. In SG–12/U these frequencies are 1.4, 2.515, 2.65, 2.88, 4.3, 4.45, 5.00, 5.35, and 15.0 mc. Two spare positions are provided for future use. In SG–12A/U these frequencies are 1.37, 1.40, 1.43, 4.27, 4.30, 4.33, 4.45, 5.00, 5.35, and 15.00 mc and one spare position is provided for future use.

Page 20, paragraph 22*a*(2). Lines 5 and 6. Change "60" mc to: **50** mc.

Page 26, paragraph 30. Delete the second sentence and substitute:

A No. 6 allen wrench is furnished with Signal Generator SG–12A/U.

Page 29, paragraph 34*b*(1). Change the references in the last sentence to read: **See figure 5 for tube locations.**

Page 29, paragraph 34*b*(2). Change the references in the last sentence to read: **See figures 13, 14, 33, 33.1, 35, 35.1, 36, 37, 37.1, 40, and 40.1 for capacitor locations.**

Page 29, paragraph 34*b*(4). Change the reference in the last sentence to read: **See figures 40 and 40.1 for terminal board locations.**

Page 29, paragraph 34*b*(7). Change the references in the last sentence to read: **Refer to figures 13, 14, 32, 33, 33.1, 34, 35, and 35.1 for component locations.**

42.1 Interchangeable Tubes

(Added)

Refer to the chart below. The older type tube can be used interchangeably with the corresponding preferred type tube. The second column lists the stages in which the tubes can be used in Signal Generator SG–12/U. The preferred type tubes are supplied with Signal Generator SG–12A/U.

Older type tube	Application	Preferred tube
6J6	V6, rf oscillator	6J6W
5Y3GT	V10, rectifier	5Y3WGTA
6C4	V9, modulator af output, and V12 and V13 if. oscillators.	6C4W

Page 38, paragraph 46. Line 3. Change "refer to figures 48 and 49" to read: **refer to figures 48, 49, and 50.**

Page 38, paragraph 46*d*. Line 2. Change "6J6" to read: **6J6 (or 6J6W).**

Page 39, figure 16.

NOTE (Added): IN SIGNAL GENERATOR SG–12A/U:
V6 IS TUBE TYPE 6J6W
V9, V12, AND V13 ARE TUBE TYPE 6C4W
V10 IS TUBE TYPE 5Y3WGTA.

Page 40, paragraph 46*h*. Line 3. Change "6C4" to read: **6C4 (or 6C4W).**

Page 40, paragraph 46*h*. Delete the sentence "Nine crystal frequencies *** associated tuned circuits." and substitute the following:

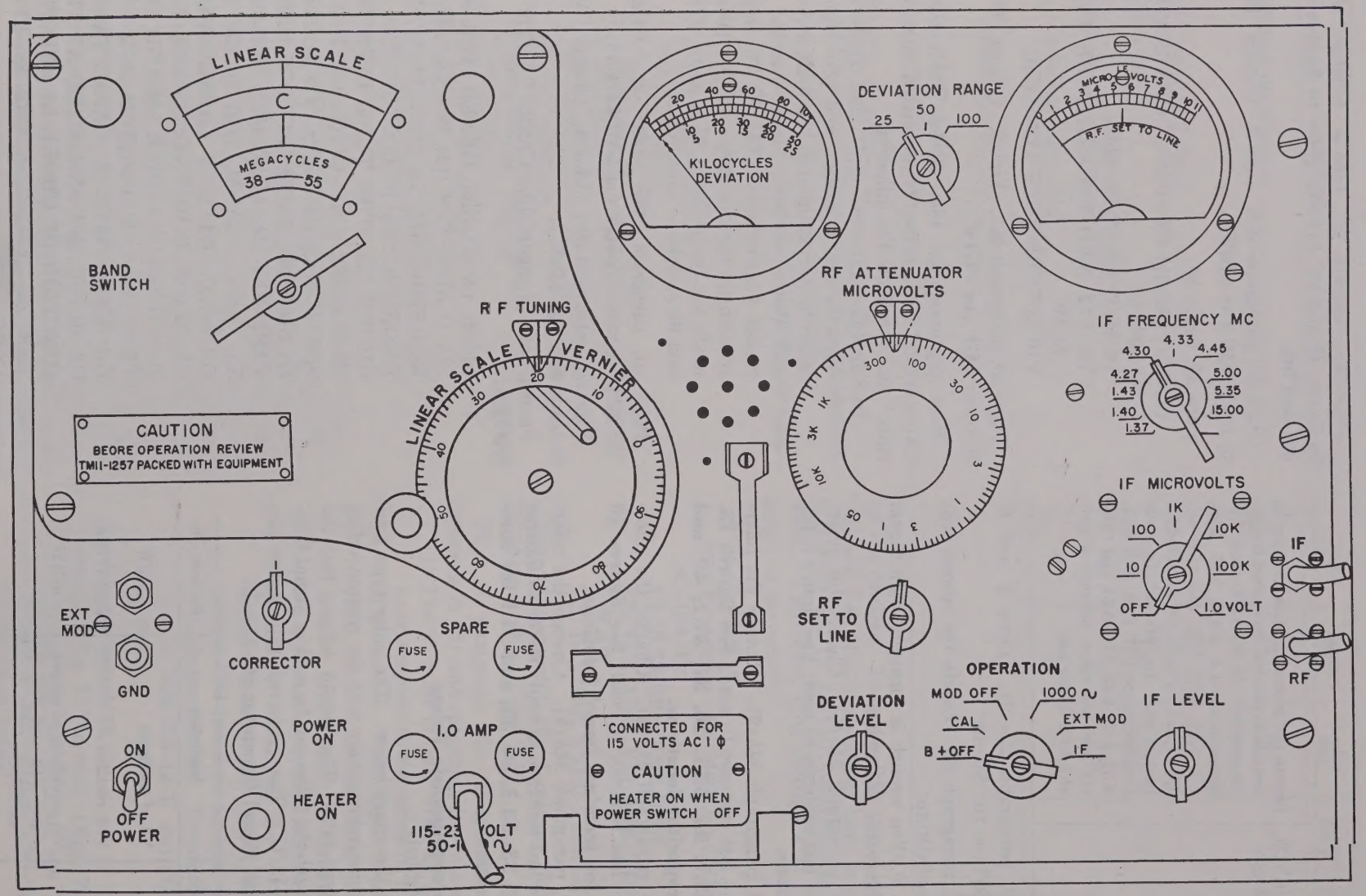
In Signal Generator SG–12/U, nine crystal frequencies are available, and provision is made for the addition of two more crystals and their associated tuned circuits. In Signal Generator SG–12A/U, 10 crystal frequencies are available, and provision is made for the addition of 1 more crystal and its associated tuned circuit.

Page 40, paragraph 46*j*. Line 11. Change "5Y3GT" to read: **5Y3GT (or 5Y3WGTA).**

Page 44, paragraph 50*a*. Line 4. Change "6J6" to read: **6J6 (or 6J6W).**

Facing page 44, figure 19. Change "NOTE" to **NOTES:**

4. (Added) IN SIGNAL GENERATOR SG–12A/U RESISTOR R24 IS 6,800 OHMS; RESISTOR R25 IS DELETED AND RESISTOR R24 IS CONNECTED TO CHOKE L3. THE TUBE TYPE FOR V6 IS 6J6W. CAPACITOR C25 IS A 2-SECTION CAPACITOR CONNECTED IN SERIES. EACH SECTION HAS A VARIABLE CAPACITANCE OF 1.8 TO 5.1 μμF. CAPACITOR C75 TO GROUND, WITH A CAPACITANCE OF .01 μμF, IS CONNECTED AT THE JUNCTION OF CHOKE L36 AND FILTER Z16. CAPACITOR C73 TO GROUND, WITH A CAPACITANCE OF .01 μμF, IS CONNECTED AT THE JUNCTION OF CHOKE L7 AND FILTER Z9. CRYSTAL CR2 IS TYPE 1N21C.



TM1257-C2-8

Figure 7.1 (Added). *Signal Generator SG–12A/U, front panel view.*

Page 48, paragraph 53*c*. Line 1. Change "6C4" to read: **6C4 (or 6C4W).**

Page 49, figure 22. Change "NOTE" to **NOTES.**

4. (Added) IN SIGNAL GENERATOR SG–12A/U TUBE V9 IS A TYPE 6C4W. RESISTORS R60, R61, AND R62 ARE EACH 25K.

Page 50, figure 23. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TERMINAL 3 OF TRANSFORMER T1 IS CONNECTED TO GROUND AND TERMINAL 9 OF J8. TERMINAL 4 OF TRANSFORMER T1 IS CONNECTED TO TERMINAL 11 OF J8.

Page 50, paragraph 55. Line 4. Change "6C4" to read: **6C4 (or 6C4W).**

Page 50, paragraph 55. Delete the third, fourth, and fifth sentences and substitute the following:

In Signal Generator SG–12/U, there are 9 crystal frequencies available in the unit (10 for SG–12A/U) but for the explanation of the circuit, all positions of the switch are considered to operate in the same manner. Signal Generator SG–12/U has two spare turret spaces for installation of additional crystals. SG–12A/U has one spare turret space. Any crystal in the 1- to 20-mc range can be used in the spare turret spaces. Installation of crystals in the spare positions is described in *c* below.

Page 50, paragraph 55*a*. After the second sentence add:

Coil L37 and capacitor C68 make up the tuned circuit for the tenth position of the switch in Signal Generator SG–12A/U.

Page 50, paragraph 55*b*. Delete the first sentence and substitute the following:

The switching circuit for the oscillator and amplifier sections consists of switch S8 and the turret. In Signal Generator SG–12/U, the turret contains nine crystals, Y1 through Y9. In Signal Generator SG–12A/U, the turret contains 10 crystals Y1 through Y9 and Y11.

Page 51, paragraph 55*c*. Delete the first five sentences and substitute the following:

The frequency switching arrangement in the if. oscillator and amplifier circuits has two spare positions in Signal Generator SG–12/U and one spare position in SG–12A/U. Spare positions are included to provide additional if. circuits if required. To make use of a spare position it is necessary to insert the proper crystal in the turret holder, exchange the empty coil form for a wound coil, shunt the inserted coil with the proper capacitance, and wire the tuned circuit into the switching arrangement. All if. oscillator and amplifier coils use the same coil form. The two empty coil forms for each spare position are mounted in usable positions on the front and rear panels of the if. oscillator assembly.

Page 52, paragraph 55*c*. Line 4 from bottom of column. Change "figures 48 and 49" to read: **figures 48, 49, and 50.**

Page 52, figure 25. Interchange the words "front" and "rear" at S8 section 1. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TUBES V12 AND V13 ARE TYPE 6C4W AND THE FREQUENCY OF CRYSTAL Y4 IS 4.27 MC.

Page 53, paragraph 56*b*. Line 1. Change "nine" to read: **9 (or, in Signal Generator SG–12A/U, 10).**

Page 53, figure 26. Add the following to NOTE 3: IN SIGNAL GENERATOR SG–12A/U THIS IS THE 4–27 POSITION.

Page 54, figure 27. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, C70, .01 μF, IS IN SERIES WITH THE RED IF. OUTPUT LEAD AND IS LOCATED IN THE IF. CABLE TERMINATION BOX.

Page 55, paragraph 57*b*. Delete the second sentence and substitute the following:

The if. output cable is terminated by resistor R84 and, in Signal Generator SG–12A/U, blocking capacitor C70.

Page 55, figure 28. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, CRYSTAL CR2 IS TYPE 1N21C.

Page 58, figure 29. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TUBE V10 IS TYPE 5Y3WGTA.

Facing page 58, figure 30. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TUBE V10 IS A TYPE 5Y3WGTA. CAPACITOR C71, .01 μF, IS CONNECTED BETWEEN THE JUNCTION OF I 1 AND TERMINAL 15 OF P8 AND GROUND; CAPACITOR C72, .01 μF, IS CONNECTED BETWEEN THE JUNCTION OF I 2 AND TERMINAL 14 OF P8 AND GROUND; C73, .01 μF, IS CONNECTED BETWEEN THE JUNCTION OF L7 AND Z9 AND GROUND; C74, .01 μF, IS CONNECTED BETWEEN THE JUNCTION OF L2 AND Z2 AND GROUND; C75 IS CONNECTED BETWEEN THE JUNCTION OF L36 AND R107 AND GROUND.

Page 60, paragraph 61. Change the figure references in the table as follows:

"33" to read: **33 and 33.1.**
"35" to read: **35 and 35.1.**
"37" to read: **37 and 37.1.**
"39" to read: **39 and 39.1.**
"40" to read: **40 and 40.1.**
"48 and 49" to read: **48, 49, and 50.**

Page 61, paragraph 64*a*. Change the figure references in the last sentence to read: **figures 39, 39.1, 40, and 40.1.**

Page 62, figure 31.

Delete the connection between L15 and terminal 11 of transformer T2. Connect L15 to terminal 12 of transformer T2.

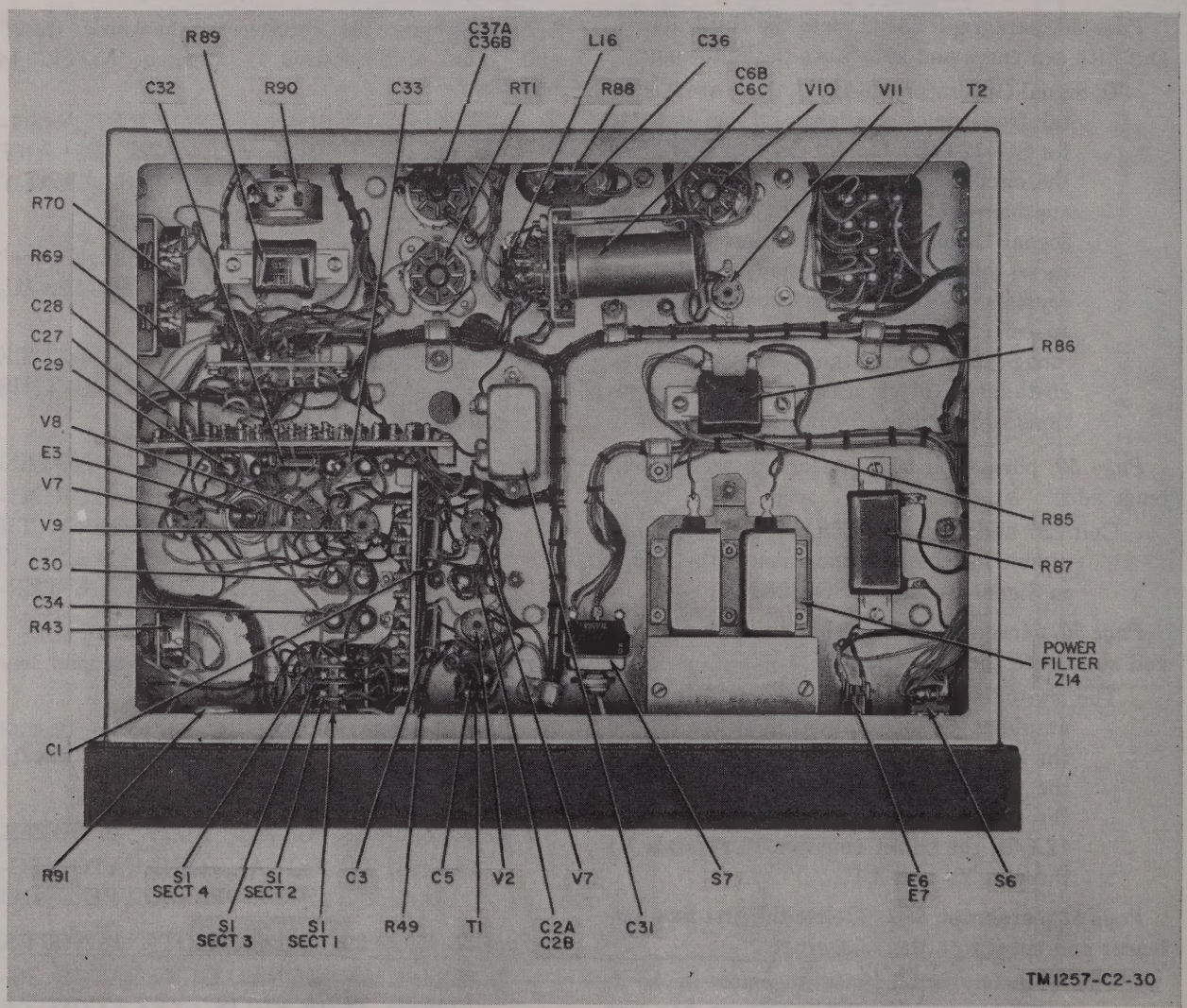


Figure 33.1 (Added). *Signal Generator SG–12A/U, bottom view of chassis*

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TUBE V6 IS TYPE 6J6W. TUBES V9, V12, and V13 ARE TYPE 6C4W, AND TUBE V10 IS TYPE 5Y3WGTA. RESISTOR R24 IS 6,800 OHMS AND IS CONNECTED DIRECTLY TO CHOKE L3. RESISTOR R25 IS NOT USED. CHANGE THE SYMBOL FOR CAPACITOR C25 TO A 2-SECTION CAPACITOR CONNECTED IN SERIES, EACH SECTION HAVING A VARIABLE CAPACITANCE OF 1.8 TO 5.1 μμF.

Page 63, paragraph 66. Change the reference in the last sentence from "figure 39" to read: **figures 39 and 39.1.**

Page 75, paragraph 76*d*. Change reference in last line to: **(figs. 48, 49, and 50).**

Page 78, paragraph 85*b*(6). Change "30 mc" to read: **39 mc.**

Page 80, figure 41. Change callout marked "R76" to: **R70**.

Page 80, figure 42. Change control marked "R32" to: **R23**.

Page 81, paragraph 89*b*. Delete the first sentence and substitute the following:

For Signal Generator SG–12/U, refer to the following chart for adjustment points in *a*(4) and (5) above.

Page 81, paragraph 89.

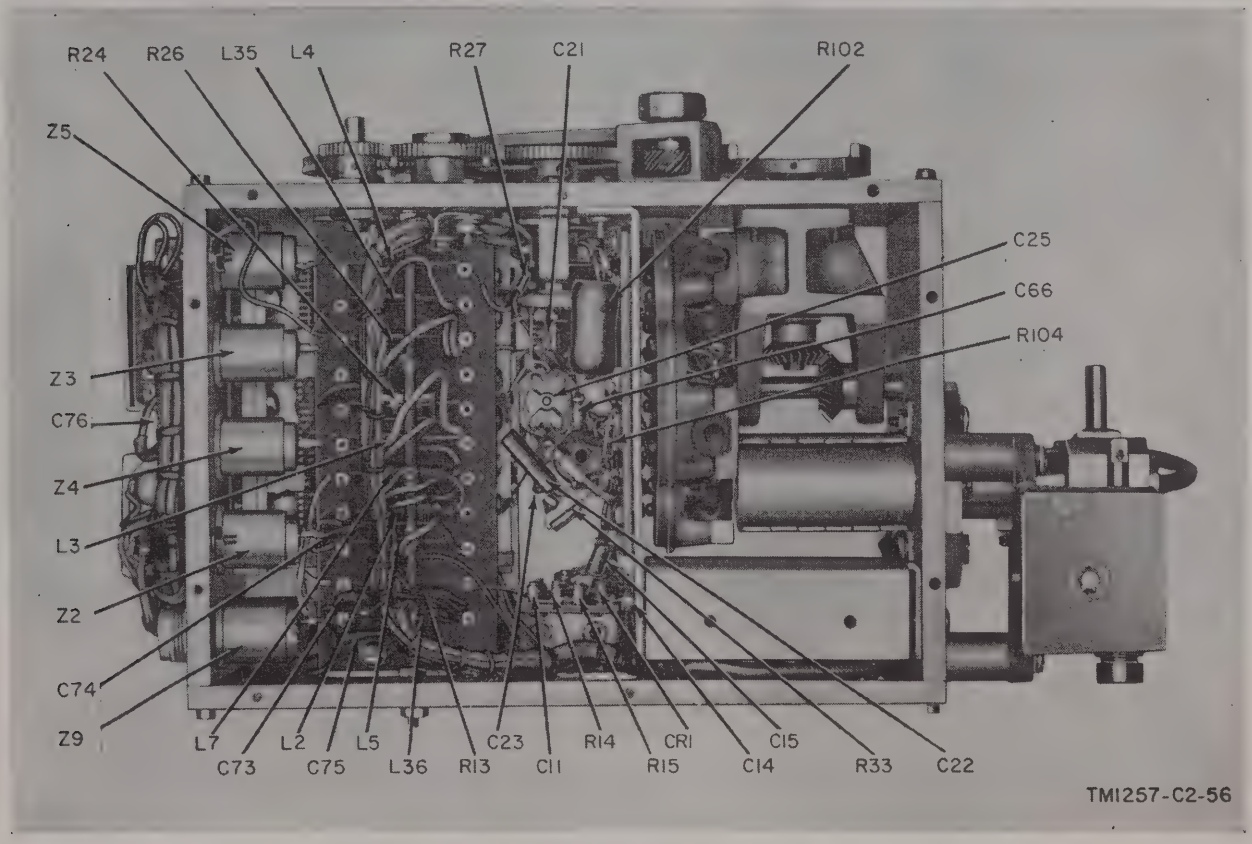


Figure 35.1 (Added). *Signal Generator SG–12A/U, rf oscillator subassembly, bottom view.*

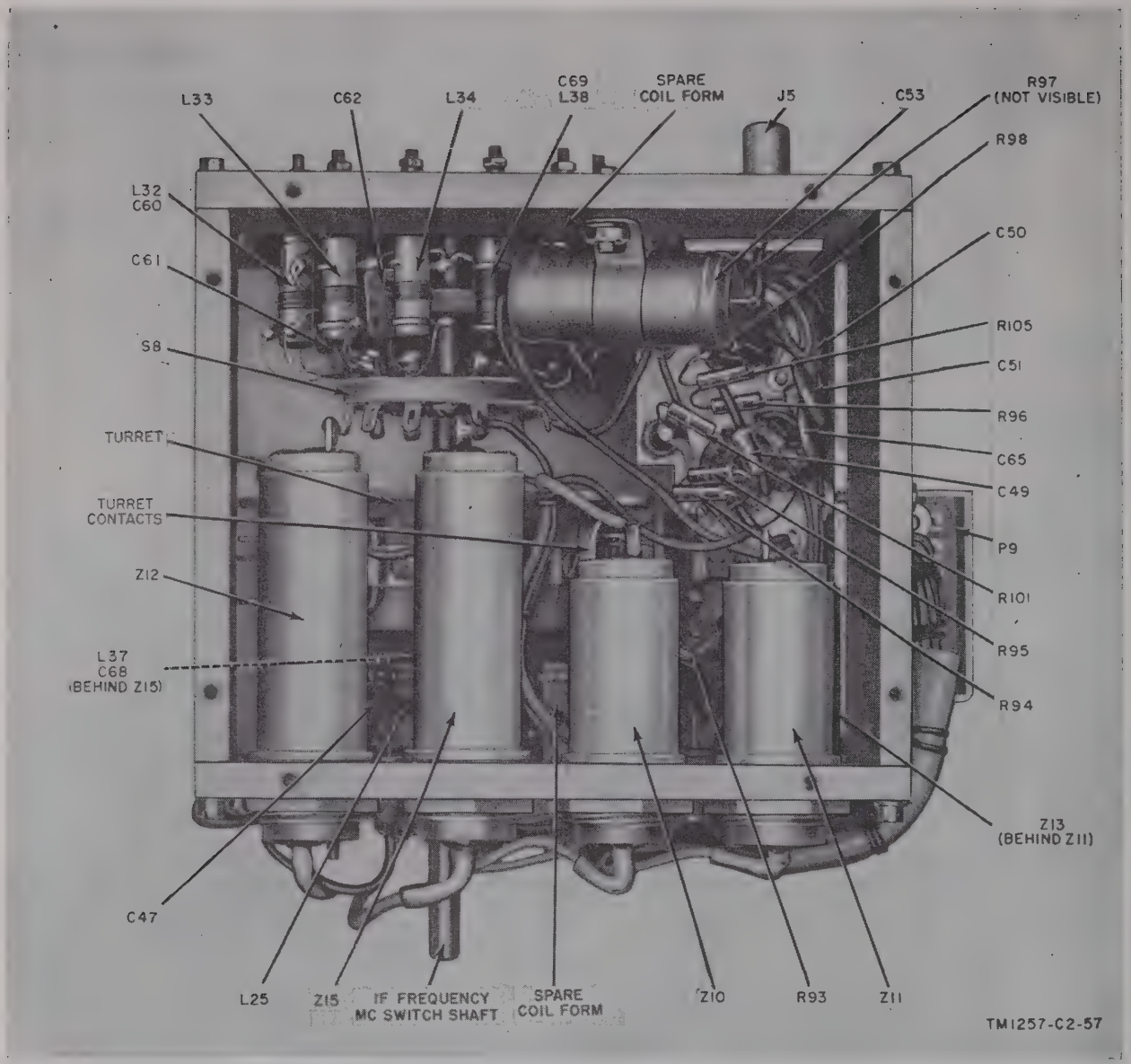
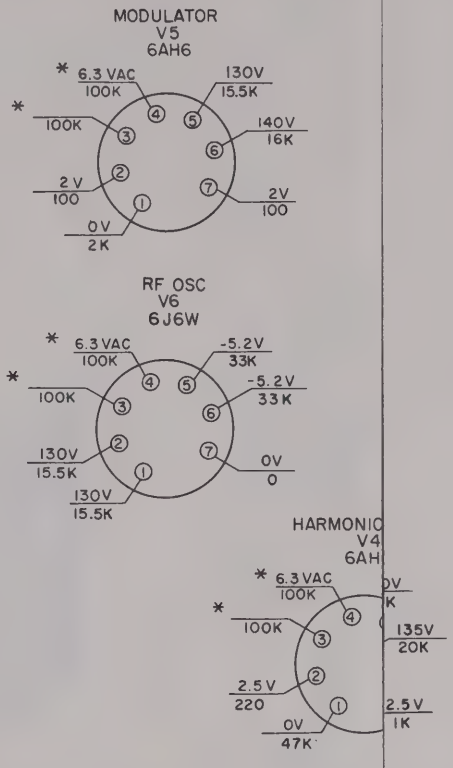


Figure 37.1 (Added). *Signal Generator SG–12A/U, if. oscillator subassembly, bottom view.*



NOTES :

1. LINE VOLTAGE 115 VOLTS.
2. ALL RESISTANCES ARE IN OHMS.
3. NM MEANS NOT MEASURED.
4. USE 20,000 OHM-PER- VOLT METER FOR DC VOLTAGE MEASUREMENTS.
5. VOLTAGES AND RESISTANCES FOR V1, V2, V3, AND V4 MEASURED WITH OPERATION SWITCH IN [CAL] POSITION.
6. VOLTAGES AND RESISTANCES FOR V5, V6, V7, V8, AND V9 MEASURED WITH OPERATION SWITCH IN [1000~] POSITION.
7. VOLTAGE AND RESISTANCES FOR V12, V13, AND V14 MEASURED WITH OPERATION SWITCH IN [I.F] POSI [IF LEVEL] CONTROL FULLY CLOCKWISE.
8. VOLTAGE READINGS ABOVE LINE. RESISTANCE READINGS BELOW LINE.
9. ALL VOLTAGE AND RESISTANCE READINGS TO GROUND UNLESS OTHERWISE SPECIFIED.

* MEASURE BETWEEN THESE PINS ON EACH TUBE FOR FILAMENT VOLTAGE.

OSC
12
4W

OSC
13
4W

AMPL
14
K6

1257-C2-35

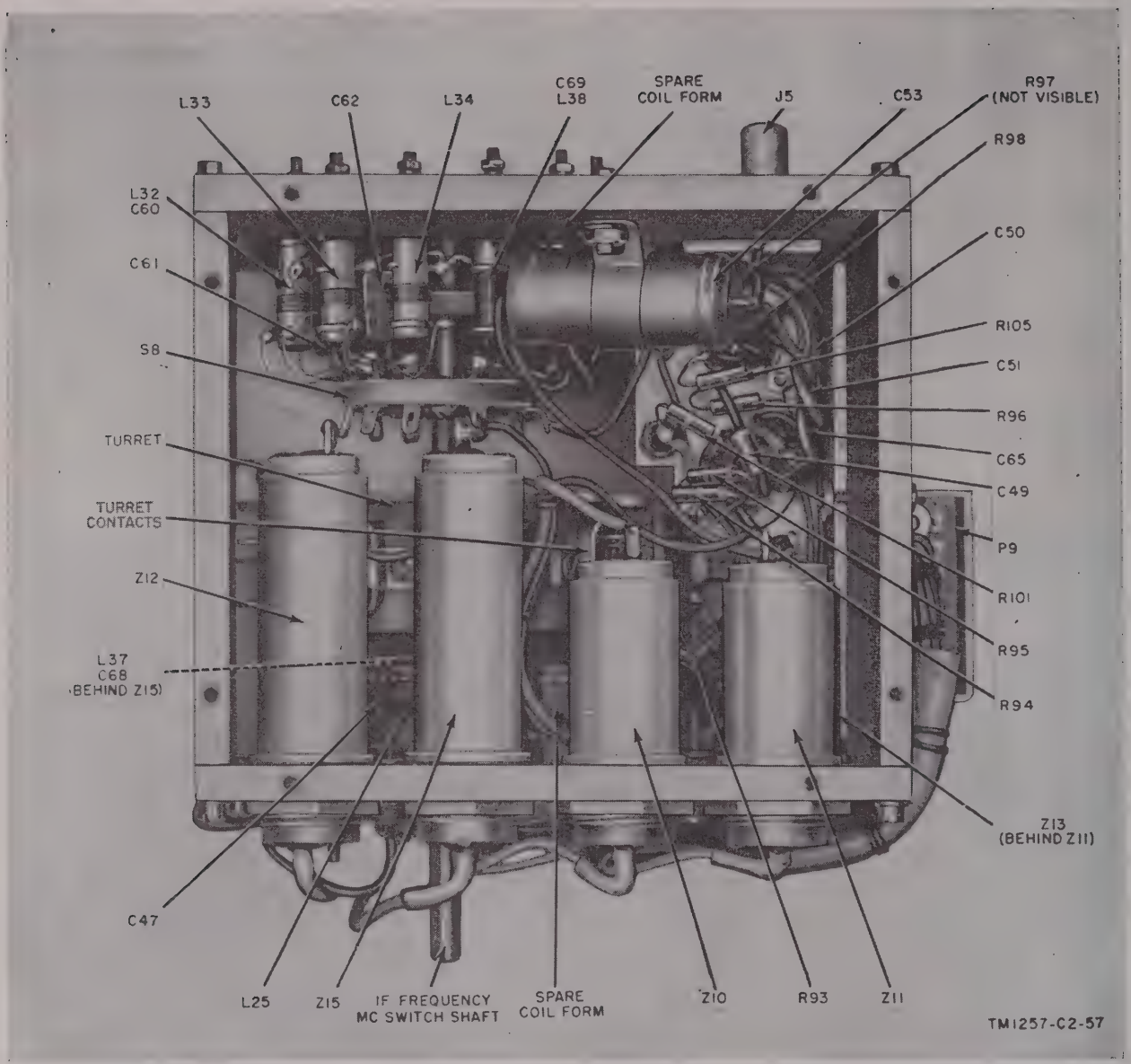
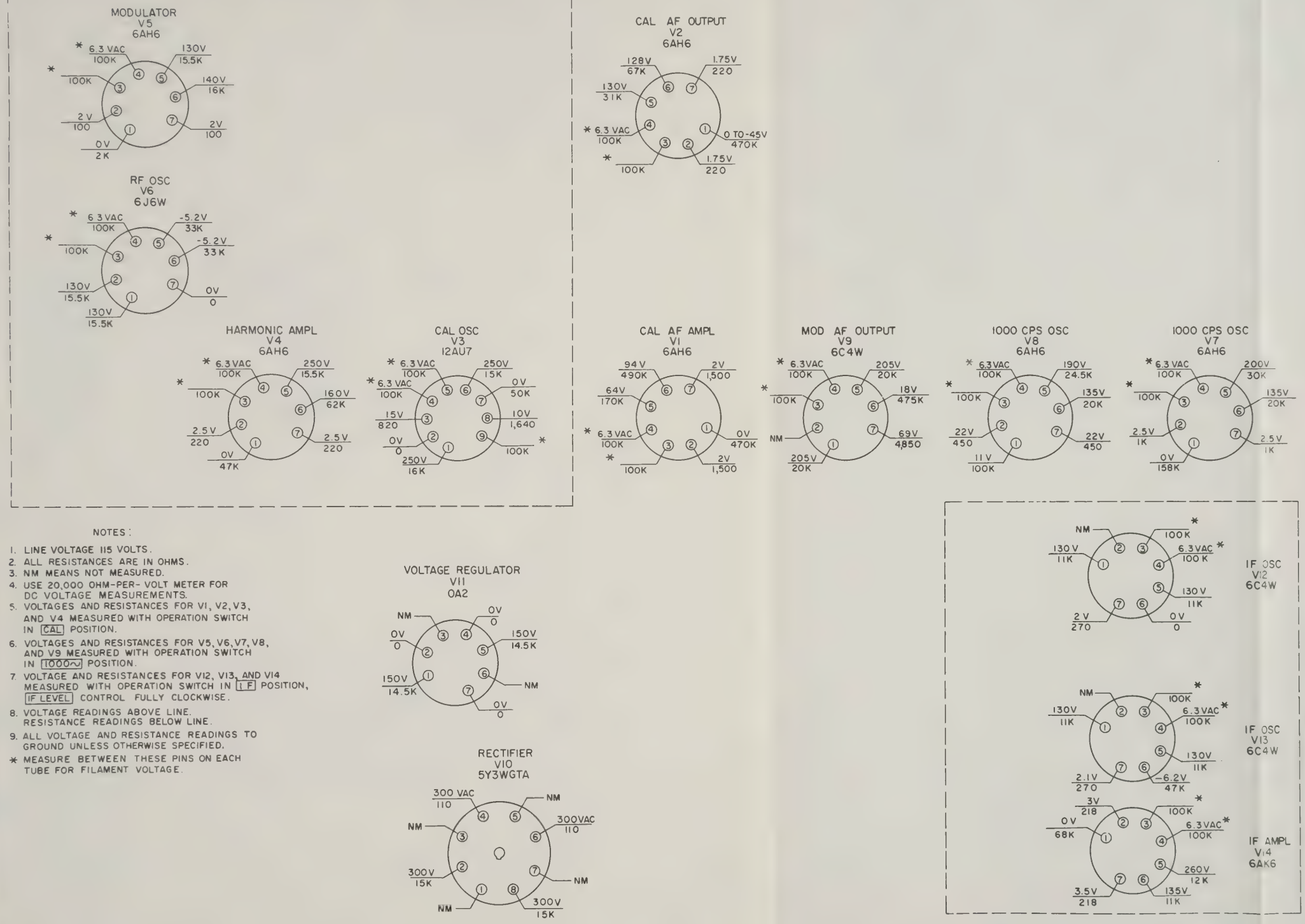


Figure 37.1 (Added). *Signal Generator SG–12A/U, if. oscillator subassembly, bottom view.*



TM1257-C2-35

Figure 39.1 (Added). *Signal Generator SG–12A/U, voltage and resistance diagram.*

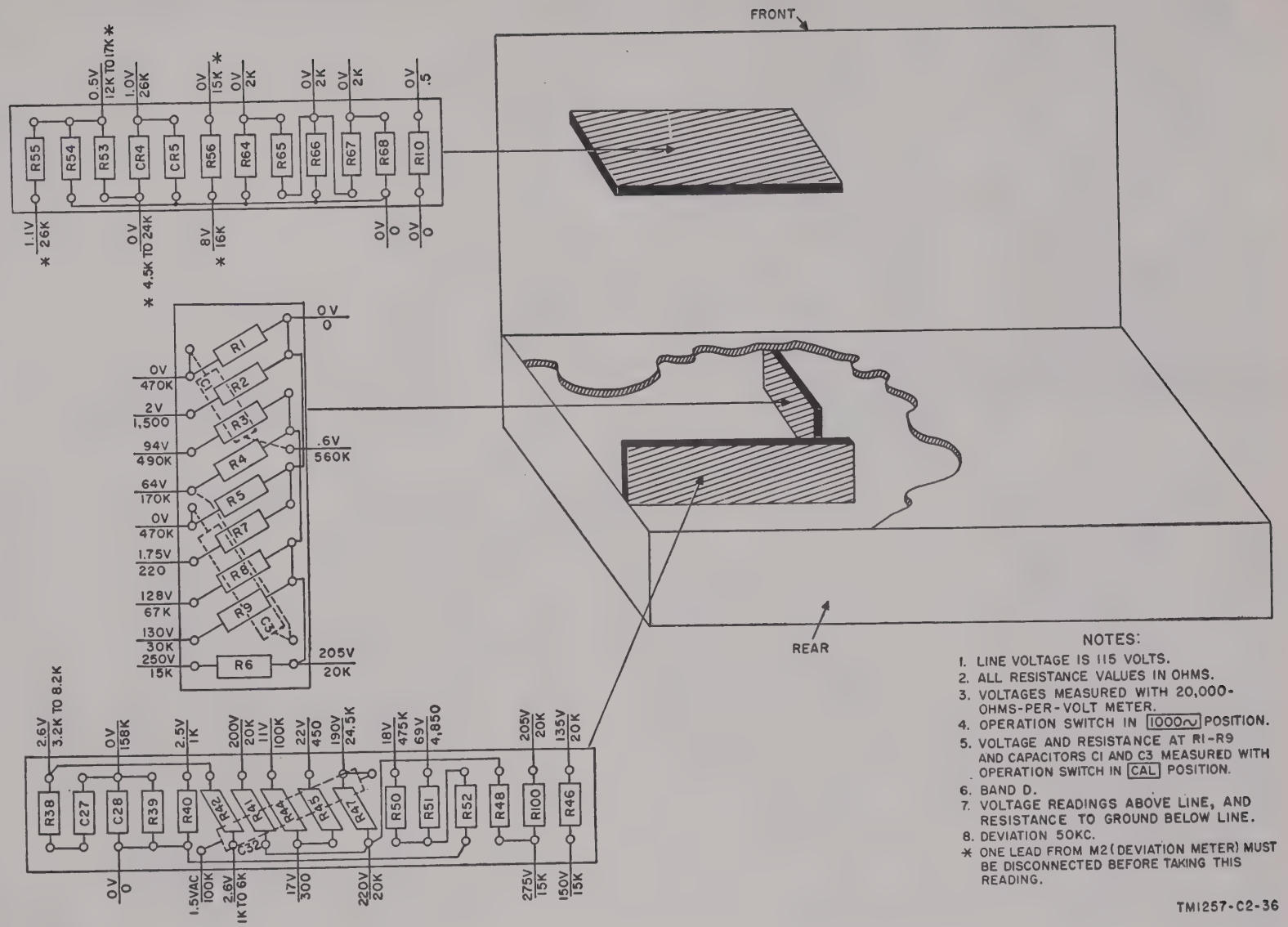


Figure 40.1. Signal Generator SG-12A/U, resistor-capacitor board location diagram.

c. (Added) For Signal Generator SG–12A/U, refer to the following chart for adjustment points in *a*(4) and (5) above.

IF. FREQUENCY MC	Adjust oscillator coil	Adjust amplifier coil
1.37	L21	L30
1.40	L20	L29
1.43	L19	L28
4.27	L18	L27
4.30	L17	L26
4.33	L22	L31
4.45	L23	L32
5.00	L24	L33
5.35	L25	L34
15.00	L37	L38

Page 82, figure 43.

NOTE (Added): IN SIGNAL GENERATOR SG–12A/U, ON THE FRONT VIEW OF THE IF. ASSEMBLY, "L37" IS STAMPED NEXT TO THE ADJUSTMENT MARKED "SPARE" WHICH IS ADJACENT TO "L25." ON THE REAR VIEW OF THE IF. ASSEMBLY, "L38" IS STAMPED NEXT TO THE ADJUSTMENT MARKED "SPARE" WHICH IS ADJACENT TO "L34".

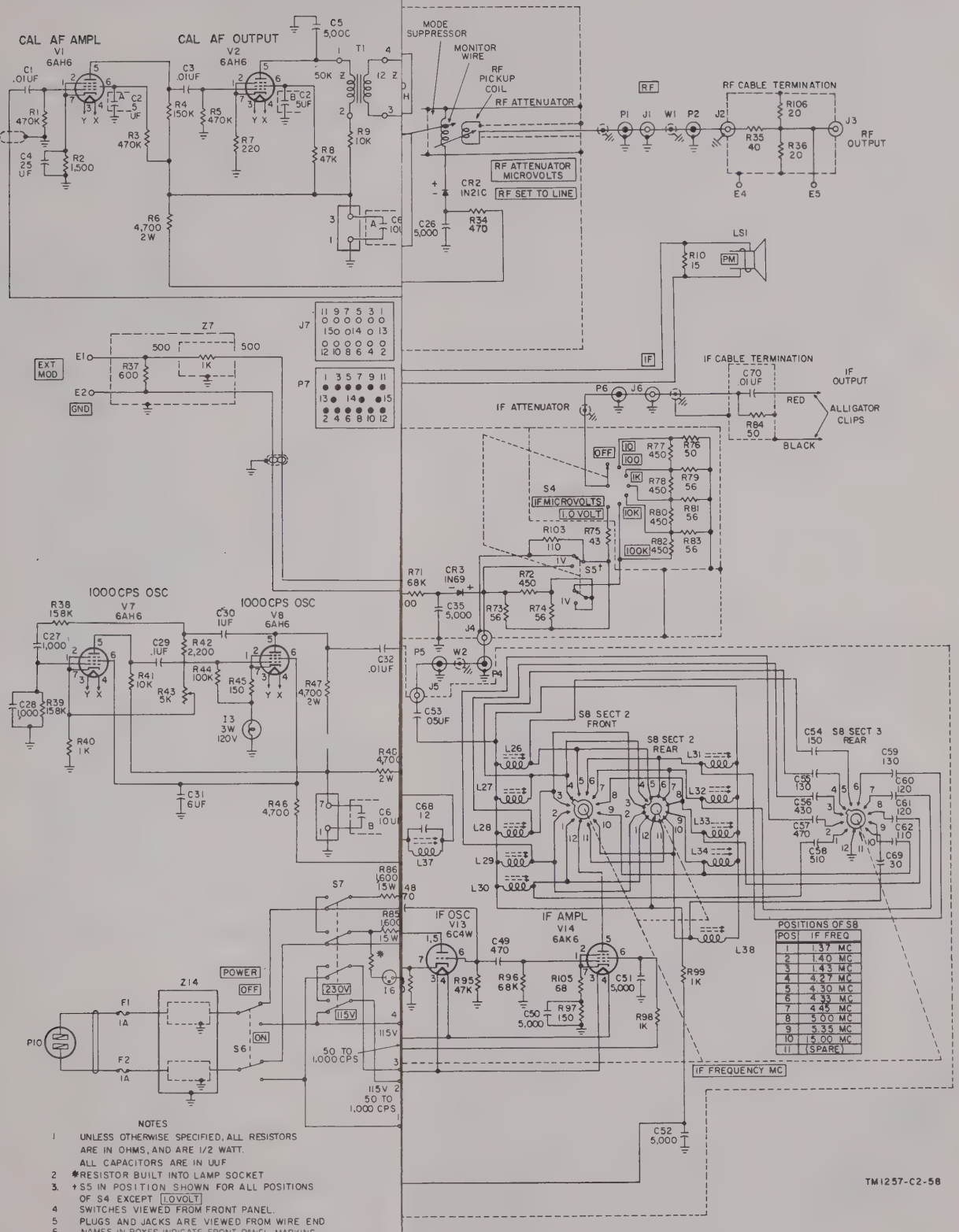
Page 86, paragraph 102*b*. Line 3. Change "±10 percent" to read: **±25 percent**.

Figure 48. (foldout) Change the value of C2 to: **5μF.**

Figure 49. (foldout) Change the value of C2 to: **5μF.** Label the resistor directly below R24: R25, 3,300, 2W.

Page 91, appendix I. Deleted.

Page 93, appendix II. Deleted.



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, AND ARE 1/2 WATT. ALL CAPACITORS ARE IN UUF
2. *RESISTOR BUILT INTO LAMP SOCKET
3. †S5 IN POSITION SHOWN FOR ALL POSITIONS OF S4 EXCEPT 1.0 VOLT
4. SWITCHES VIEWED FROM FRONT PANEL.
5. PLUGS AND JACKS ARE VIEWED FROM WIRE END
6. NAMES IN BOXES INDICATE FRONT PANEL MARKING

c. (Added) For Signal Generator SG–12A/U, refer to the following chart for adjustment points in *a*(4) and (5) above.

IF. FREQUENCY MC	Adjust oscillator coil	Adjust amplifier coil
1.37	L21	L30
1.40	L20	L29
1.43	L19	L28
4.27	L18	L27
4.30	L17	L26
4.33	L22	L31
4.45	L23	L32
5.00	L24	L33
5.35	L25	L34
15.00	L37	L38

Page 82, figure 43.

NOTE (Added): IN SIGNAL GENERATOR SG–12A/U, ON THE FRONT VIEW OF THE IF. ASSEMBLY, "L37" IS STAMPED NEXT TO THE ADJUSTMENT MARKED "SPARE" WHICH IS ADJACENT TO "L25." ON THE REAR VIEW OF THE IF. ASSEMBLY, "L38" IS STAMPED NEXT TO THE ADJUSTMENT MARKED "SPARE" WHICH IS ADJACENT TO "L34".

Page 86, paragraph 102*b*. Line 3. Change "±10 percent" to read: **±25 percent**.

Figure 48. (foldout) Change the value of C2 to: **5μF.**

Figure 49. (foldout) Change the value of C2 to: **5μF.** Label the resistor directly below R24: R25, 3,300, 2W.

Page 91, appendix I. Deleted.

Page 93, appendix II. Deleted.

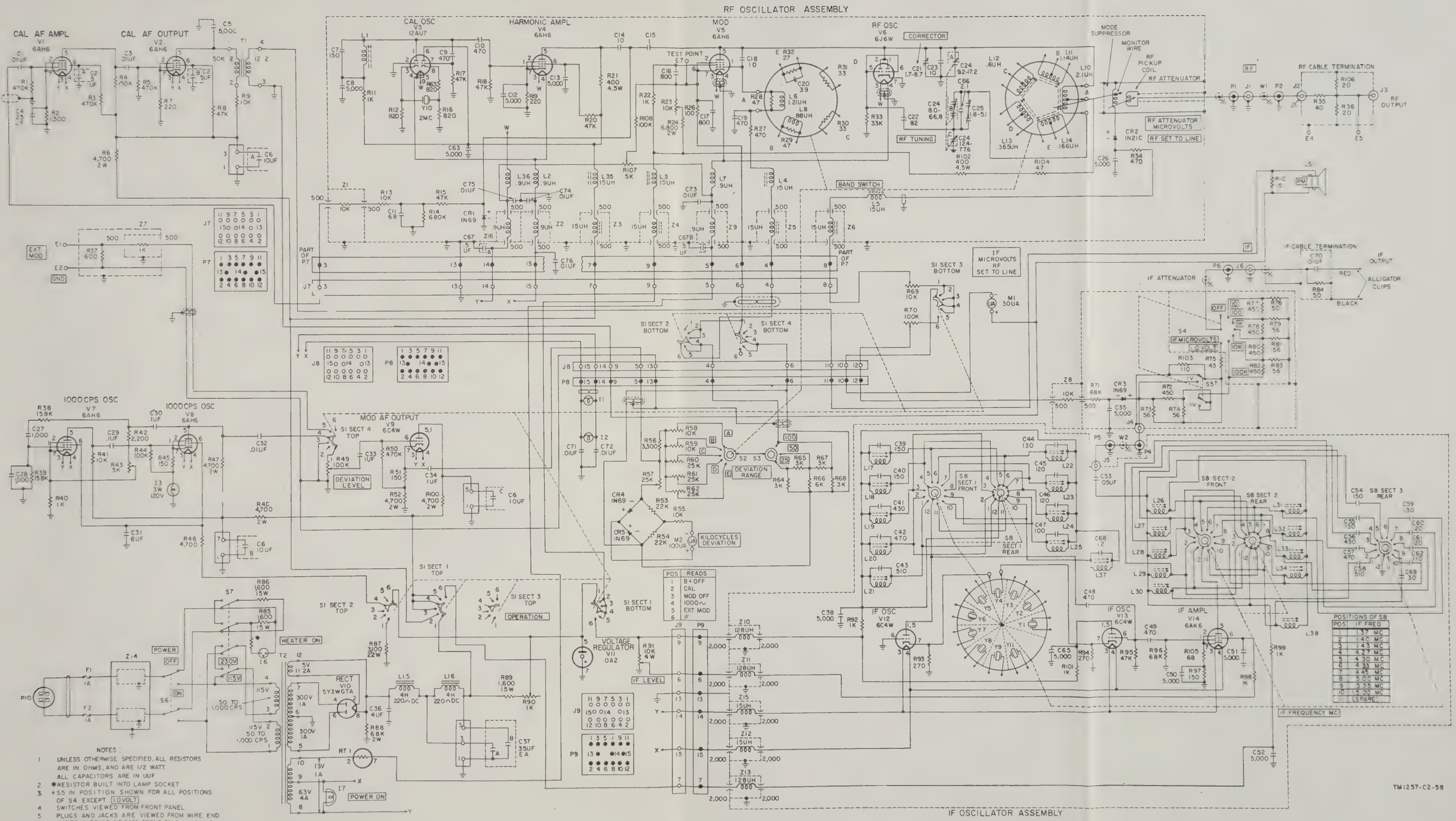


Figure 50 (Added). *Signal Generator SG–12A/U, schematic diagram.*

[AG 412.41 (31 Jul 56)]

By Order of the Secretaries of the Army and the Air Force:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

N. F. TWINING,
Chief of Staff, United States Air Force

Official:

E. E. TORO,
Colonel, United States Air Force,
Air Adjutant General.

Distribution:

Active Army:

CNGB (1)
ASA (3)
Tec Svc, DA (1) except CSIGO (30)
Tec Svc Bd (1)
Hq CONARC (5)
CONARC Bd (Incl ea Test Sec) (1)
Army AA Comd (2)
OS Maj Comd (5)
OS Base Comd (5)
Log Comd (5)
MDW (1)
Armies (5)
Corps (2)
Ft & Cp (2)
Sp Wpn Comd (2)
Army Cml Cen (4)
Gen & Br Svc Sch (5) except Sig Sch (25)
Gen Depots (2) except Atlanta Gen Depot (None)
Sig Sec, Gen Depots (10)
Sig Depots (17)
US Army Tng Cen (2)
POE (OS) (2)
Trans Terminal Comd (2)
Army Terminals (2)
OS Sup Agencies (2)
Army Elct PG (1)
Sig Fld Maint Shops (3)
Sig Lab (5)
ACS (3)
Sandia Base, AFSWP (2)
Mil Dist (1)
Units org under fol TOE:
11–7C, Sig Co, Inf Div (2)
11–16C, Hq & HqCo, Sig Bn, Corps or Abn Corps (2)
11–57C, Armd Sig Co (2)
11–127R, Sig Rep Co (2)
11–128R, Sig Depot Co (2)
11–500R (AA–AE), Sig Svc Org (2)
11–557C, Abn Sig Co (2)
11–587R, Sig Base Maint Co (2)
11–592R, Hq & Hq Co, Sig Base Depot (2)
11–597R, Sig Base Depot Co (2)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1968 O - 300-512 (9938A)

SIGNAL GENERATOR AN/URM–48

TM 11–1257
TO 33A1–8–18–1
CHANGES No. 3

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., *2 May 1961*

TM 11–1257/TO 33A1–8–18–1, 8 December 1953, is changed as follows:

Note. The parenthetical references to previous changes ("example: page 2 of C2") indicate that pertinent material was published in that change.

Page 11, paragraph 10 (page 2 of C 2), "Signal Generator SG–12A/U" column, item 9. After "5 fuses, 1-ampere," add: slow blow.

Page 18. After paragraph 18 add:

Note. A difference of potential exists between the chassis of Signal Generator SG–12(*)/U, a component of Signal Generator AN/URM–48, and the equipment under test. The use of capacitors as ac line filters causes this difference in potential, which is annoying but not dangerous. To eliminate this voltage, connect the chassis of the equipment under test to the external ground terminal of the signal generator.

Page 82. After section III, add:

Section III.1. FOURTH ECHELON TESTING PROCEDURES

90.1 General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures set fourth specific requirements that repaired signal equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide for testing equipment repaired at third echelon if the proper tools and test equipments are available. A summary of the performance standards is given in paragraph 90.13.

b. Each test depends on the preceding one for certain operating procedures and where applicable, for test equipment calibrations. Comply with the instructions preceding each chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all the actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

90.2 Test Equipment and Materials

All test equipment and materials required to perform the testing procedures given in this section are listed in the following charts and are authorized under TA 11–17, Signal Field Maintenance Shops, and TA 11–100–(11–17), Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States, except as noted.

a. Test Equipment.

Nomenclature	Federal stock No.	Technical manual
Frequency Meter FR–4/U (p/o Frequency Meter AN/URM–79)	6625–668–9749	TM 11–5094
Frequency Meter AN/URM–80	6625–649–4286	TM 11–5095
Signal Generator TS–497(*)/URR [a]	6625–669–0258	TM 11–5030 TM 11–5030A
Audio Oscillator TS–382(*)/U [b]	6626–192–5094	TM 11–2684A
Spectrum Analyzer TS–723(*)/U [c]	6625–668–9418	TM 11–5097
Frequency Meter FR–67/U [d]	6625–356–0256	TM 11–2698

Nomenclature	Federal stock No.	Technical manual
Panoramic Indicator IP–173/U	5820–224–5500	TM 11–5086
Panoramic Indicator IP–173A/U [e]	5820–699–8116	
Field Strength Meter IM–117/URM–91 (p/o AN/URM–91)	6625–521–1270	TM 11–5041
Field Strength Meter TS–579(*)/U [f]	6625–242–5950	TM 11–5041
Wattmeter AN/URM–98	6625–566–4990	TM 11–5124
Electronic Multimeter TS–505(*)/U [g]	6625–243–0562	TM 11–6625–239–12
		TM 11–5511
Electronic Multimeter ME–30(*)/U [h]	6625–669–0742	TM 11–5132
Light Assembly, Electric MX–1292/PAQ	6695–537–4470	TM 11–5540

[a] Indicates models TS–497A/URR, TS–497B/URR, and TS–497C/URR.

[b] Indicates models TS–382A/U, TS–382B/U, TS–382D/U, TS–382E/U, and TS–382F/U.

[c] Indicates models TS–723/U, TS–723A/U, and TS–723B/U.

[d] Frequency Meter AN/TSM–16 and Radio Interference Measuring Set AN/URM–85, authorized under TA 11–17 were purposely omitted in favor of frequency Meter FR–67/U and Field Strength Meter, TS–579/U which are most likely to be available. Frequency Meter AN/TSM–16 and Radio Interference Measuring Set AN/URM–85 may be used if available.

[e] Indicates stock number for IP–173A/U.

[f] Indicates models TS–579/U, and TS–597A/U.

[g] Indicates models TS–505/U, TS–505A/U, TS–505B/U, TS–505C/U, and TS–505D/U.

[h] Indicates models ME–30A/U, and ME–30B/U.

b. Materials and Other Equipment.

Nomenclature	Federal stock No.	Reference
Radio Receiver R–390/URR	5820–503–1242	TM 11–856
Headset HS–30/U	5965–164–7259	None.
Adapter Connector UG–29B/U	5935–149–3950	None.
Adapter Connector UG–201/U	5935–201–3096	None.
Telephone plug, Type No. PJ–055B	5935–192–4760	None.
Cable, 2 cond; standard; #18AWG 3 ft [a]	6245–251–3542	None.

[a] Any two-conductor, insulated, standard cable, or two 3-foot lengths of hookup wire will be suitable.

Note. A special purpose test cable is required to make connections to the audio output jack of Field Strength Meter AN/URM–91 in the modulation distortion and frequency test and the noise test (pars. 90.9 and 90.10). Fabricate this cable using figure 43.1 as a guide. The necessary materials are listed in the chart above.

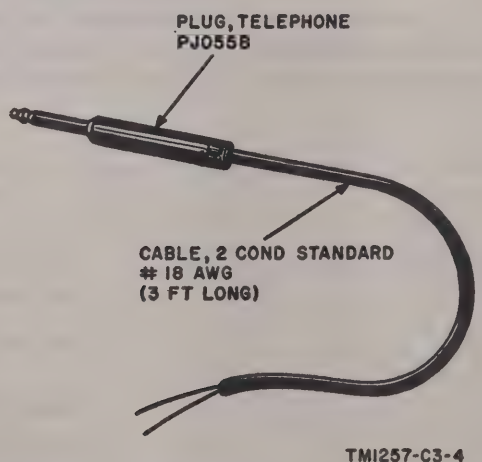


Figure 43.1 Special test cable fabrication.

90.3 Modification Work Orders

The performance standards listed in the tests (pars. 90.5–90.13) assume that the modification work orders listed below have been performed. A list of modification work orders is published in DA Pamphlet 310–4.

MWO No.	Date	Priority	Echelon	Location of MWO marking	Remarks
11–6625–267–45/2	9 Jun 59	4	4 and 5	Front of panel beneath or adjacent to nameplate.	Applies to Signal Generator SG–12/U only, all sets including depot stocks.

90.4. Moistureproofing and Fungiproofing

All parts and areas disturbed by repair and for testing will be checked for proper moistureproofing and fungiproofing.

90.5. Physical Tests and Inspection

a. Test Equipment and Materials

Light Assembly, Electric MX–1292/PAQ
Electronic Multimeter TS–505A/U

b. Test Connections and Conditions.

(1) Do not connect the SG–12A/U to a source of power for this test.

(2) Prepare the electric light assembly for operation by connecting the mercury vapor lamp with the wide transmission filter installed.

(3) The moistureproofing and fungiproofing test (step No. 5 below) should be conducted after repairs have been completed but before the chassis has been assembled in its cabinet.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	None.	Controls may be in any position.	*a.* Inspect the SG–12A/U for loose and missing screws, nuts, and other small parts.	*a.* All screws and nuts are tight. No parts are missing.
			b. Inspect the RF and IF output cables, and the line cord for condition of the cable, and of the cable termination.	*b.* The cables are in good condition free from cuts, cracks, abrasions, burns, signs of deterioration or other damage. Terminations are properly and firmly attached to the cables and are free from damage.
			c. Inspect the SG–12A/U and dust cover (cabinet) for evidence of physical damage and condition of finish and panel lettering. *Note.* Touchup painting is recommended in lieu of refinishing whenever practicable.	*c.* No physical damage is evident. All surfaces intended to be painted do not show bare metal. Panel lettering is legible.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
			d. Remove the fuseholder caps and inspect the fuseholders (and caps) for damage. Check the fuses for correct size and type.	*d.* The fuseholders (and caps) are not damaged. Fuses are 1 ampere of the slow-blow type.
			e. Check the KILOCYCLES DEVIATION meter, and the IF MICROVOLTS, RF. SET TO LINE meter for condition of the pointers and meter zero settings.	*e.* The meter pointers are straight and are not at zero indication on the meter scales with the SG–12A/U in normal operating position.
			f. If available, inspect the Case CY–1217/U (transit case) for loose and missing parts, damage, and condition of finish.	*f.* The transit case is not damaged nor are any parts loose or missing. All surfaces intended to be painted do not show bare metal.
2	None.	Controls may be in any position.	*a.* Turn the knobs of the following switches to *each* of their indicated positions: (1) OPERATION. (2) IF MICROVOLTS. (3) IF FREQUENCY MC. (4) DEVIATION RANGE.	*a.* The switch functions smoothly without binding or excessive looseness. Switch detents are positive. Switch knobs are tight on their shafts and properly indexed.
			b. Turn the knobs of the following controls through their limits of travel. (1) IF LEVEL. (2) DEVIATION LEVEL. (3) RF SET TO LINE. (4) CORRECTOR.	*b.* The controls operate smoothly without binding or excessive looseness. Control knobs are tight on their shafts.
			c. Turn the RF ATTENUATOR MICROVOLTS control fully clockwise to the stop.	*c.* The control turns freely without binding or excessive looseness. The knob turns the dial without slipping. The 10K dial mark lies directly under the hairline when the stop is reached.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
			d. Turn the RF ATTENUATOR MICROVOLTS control fully counterclockwise to the stop.	*d.* The control turns freely without binding or excessive looseness.
			e. Test the RF ATTENUATOR MICROVOLTS dial clutch by continuing to turn the knob counterclockwise 1 or 2 revolutions after the stop has been reached (*d* above).	*e.* The RF ATTENUATOR MICROVOLTS dial remains stationary as the knob is turned. The effort required to turn the knob is not so great as to place undue stress on the stop mechanism.
			f. Turn the BAND SWITCH knob to each of the four band positions indicated by the successive appearance of masks in the dial window labeled A, B, C, D, and E.	*f.* The BAND SWITCH functions smoothly without binding or excessive looseness. Switch detents are positive and the switch knob is tight on its shaft.
			g. Turn the RF TUNING control counterclockwise until the stop is reached. Note the indications of both the LINEAR SCALE (on the RF TUNING dial) and VERNIER dial.	*g.* The tuning mechanism operates smoothly without binding or excessive looseness. The knob turns the tuning dial without slipping. The zero marks on both the LINEAR SCALE and the VERNIER dial lie directly under the index hairline.
			h. Turn the RF TUNING control clockwise until the stop is reached. Note the indication on the LINEAR SCALE of the TUNING dial.	*h.* The tuning mechanism operates smoothly without binding or excessive looseness. The LINEAR SCALE of the RF TUNING dial indicates when the stop is reached.
			i. Test the RF TUNING dial clutch by continuing to turn the dial knob clockwise 1 or 2 revolutions after the stop has been reached (*h* above).	*i.* The RF TUNING dial remains stationary as the knob is turned. The effort required to turn the knob is not so great as to place undue stress on the RF TUNING dial stop mechanism.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
3	*TS–505A/U* Function switch: OHMS. RANGE switch: 2.5V–RXI.	N/A	*a.* Inspect Electrical Dummy Load DA–69/URM–48 dummy antenna for damage, loose, and missing parts.	*a.* There are no loose or missing screws or other small parts. No damage is evident.
			b. Prepare the TS–505A/U for making resistance measurements as follows: (1) Connect power cord to 115 vac source. (2) Adjust the OHMS ADJ control for a full scale (infinity) indication on the OHMS scale of the meter. (3) Short the probe tips of the OHMS and COMMON leads together, and adjust the ZERO ADJ control for an indication of zero on the meter.	*b.* None.
			c. Connect the COMMON probe to the center conductor of one dummy antenna connector connector and the tip of the OHMS probe to the center conductor of the other connector. Note the indication on the TS–505A/U meter (OHMS scale).	c. The meter indicates within 64–72 ohms.
4	Same as step No. 3.	N/A	*a.* Remove the RF OUTPUT cable head from the RF OUTPUT cable and inspect it for damage, loose, or missing parts.	*a.* There are no loose or missing screws or other small parts. No damage is evident.
			b. Touch the COMMON probe tip of the TS–505A/U to the case of the RF OUTPUT cable termination head and touch the OHMS probe tip to the center conductor of the female connector. Note the indication on the meter.	*b.* The meter indicates within 47.5–52.5 ohms.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
			c. Touch the COMMON probe tip of the electronic multimeter to the case of the RF OUTPUT cable termination head and touch the OHMS probe tip to the center conductor of the *male* connector. Note the indication on the meter.	*c.* The meter indicates within 9.5–10.5 ohms.
5	*MX–1292/PAQ* 245V FOR MV LAMP switch: OFF.	Controls may be in any position.	*a.* Connect the power cord of MX–1292/PAQ to a source of 115 volt, 60-cycle power and turn on the mercury vapor lamp (switch labeled 245V FOR MV LAMP).	*a.* None.
			b. Expose the areas of the SG–12A/U that have been repaired or otherwise disturbed to the direct rays of the lamp.	*b.* All electrical components, wires, connections, and chassis surfaces show continuous unbroken coverage. There must be *no* varnish on switch contacts or moving parts of mechanical assemblies. *Note.* Moistureproofing and fungiproofing varnish glows gray-green when exposed to the rays of the lamp.
6	N/A	Controls may be in any position.	Check the equipment for applicable MWO's and proper marking. *Note.* See paragraph 90.3 for a list of applicable and allied information.	All applicable MWO's have been performed. The equipment bears the proper markings in the designated location for each MWO applied.

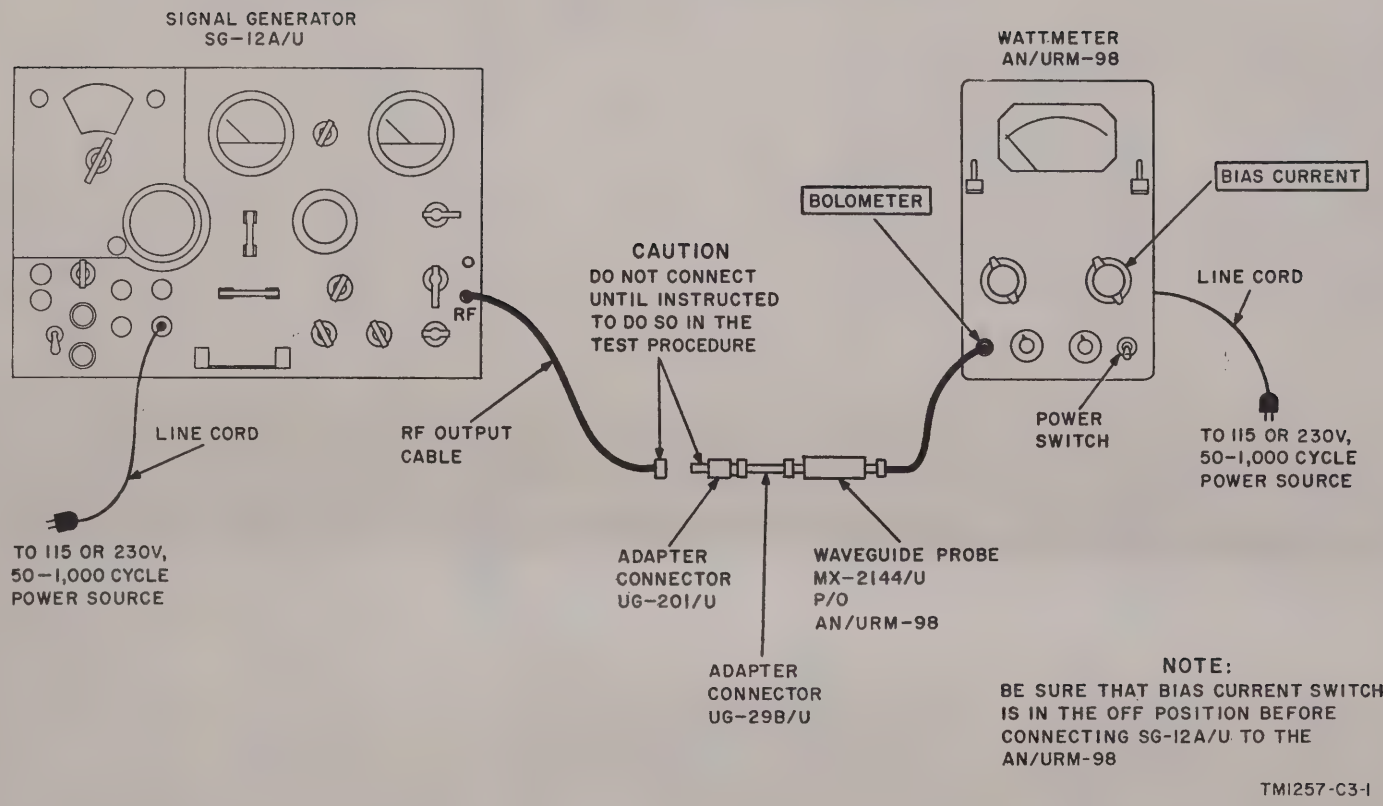


Figure 43.2. RF output test.

		CYCLES.	through *a*.	
3		BAND SWITCH: Band B. RF TUNING: 27 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
4		RF TUNING: 39 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
5		BAND SWITCH: Band C. RF TUNING: 37 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
6		RF TUNING: 56 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
7		BAND SWITCH: Band D. RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
8		RF TUNING: 70 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
9		BAND SWITCH: Band E. RF TUNING: 66 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
10		RF TUNING: 102 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.

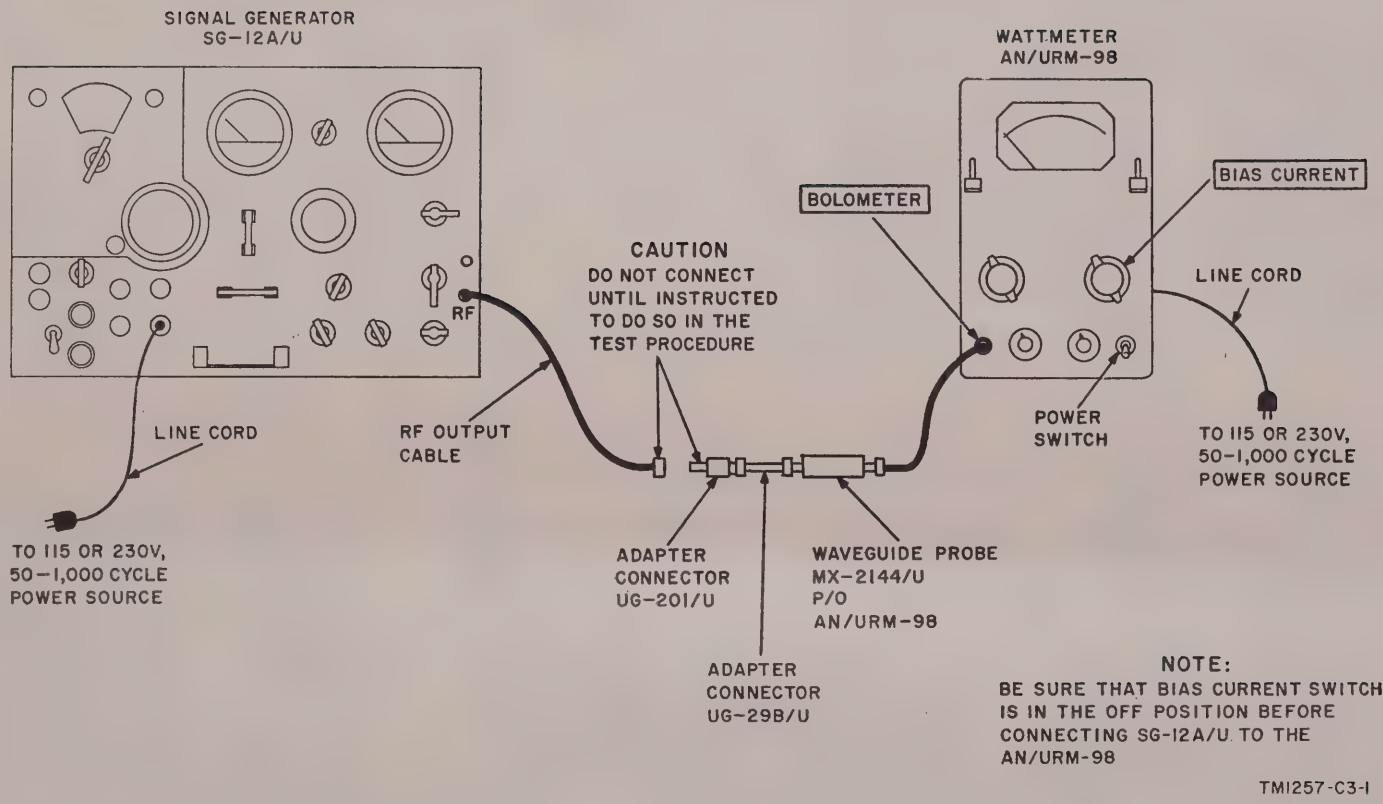


Figure 43.2. RF output test.

90.6 RF Output Test

a. Test Equipment and Materials.
Wattmeter AN/URM–98
Adapter Connector UG–29B/U
Adapter Connector UG–201/U

b. Test Connections and Conditions. Do not connect the SG–12A/U to the AN/URM–98 (fig. 43.2) until instructed to do so in the test procedures.

Caution: **Be sure that the BIAS CURRENT switch on the AN/URM–98 is in the OFF position before connecting UG–201/U to AN/URM–98.**

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*AN/URM–98* COEF. switch: NEG. RES. switch: 200. POWER RANGE: 10 MW—, +10 DBM. ZERO SET COARSE: Fully clockwise. ZERO SET FINE: Fully clockwise. BIAS CURRENT: 0–6 MA. Power: ON.	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES. RF ATTENUATOR MICROVOLTS: 10K. OPERATION: MOD OFF. POWER switch: ON.	*a.* Zero set the AN/URM–98; use the procedure in (1) or (2) below, whichever is applicable. (1) If the meter pointer is on scale or off scale at the high end, zero set the meter with the ZERO SET controls. Rotate the COARSE control counterclockwise until the pointer is close to zero; then rotate the FINE control counterclockwise until the pointer is at zero. (2) If the meter is off the scale at the low end, increase the BIAS CURRENT switch setting 1 step at a time until the pointer moves on scale or off scale at the high end. Zero set the meter with the ZERO SET controls as described in (1) above. *Note.* The AN/URM–98 may require as long as 1 hour to stabilize. During this period, the meter pointer may continually drift, which necessitates frequent readjustment of the ZERO SET controls. *b.* Adjust the SG–12A/U RF SET TO LINE control for an RF SET TO LINE indication of the IF MICROVOLTS, RF SET TO LINE meter. *c.* Readjust the AN/URM–98 ZERO SET controls for a zero indication on the meter then quickly connect the SG–12A/U RF output cable to the AN/URM–98 and note the immediate indication on the AN/URM–98 meter. *Note.* The procedure in *c* above must be performed quickly in order to obtain a reading before the AN/URM–98 drifts off ZERO SET. Repeat this procedure several times to insure that an accurate measurement has been made. *d.* Disconnect the SG–12A/U RF output cable at UG–201/U and continue to step No. 2.	*a.* None. *b.* None. *c.* The immediate indication on the AN/URM–98 is between .375 and .625 on the 0.1 MILLIWATTS scale (.0375- .0625 milliwatts of power). *d.* None.
2		RF TUNING: 29 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
3		BAND SWITCH: Band B. RF TUNING: 27 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
4		RF TUNING: 39 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
5		BAND SWITCH: Band C. RF TUNING: 37 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
6		RF TUNING: 56 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
7		BAND SWITCH: Band D. RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
8		RF TUNING: 70 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
9		BAND SWITCH: Band E. RF TUNING: 66 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
10		RF TUNING: 102 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.

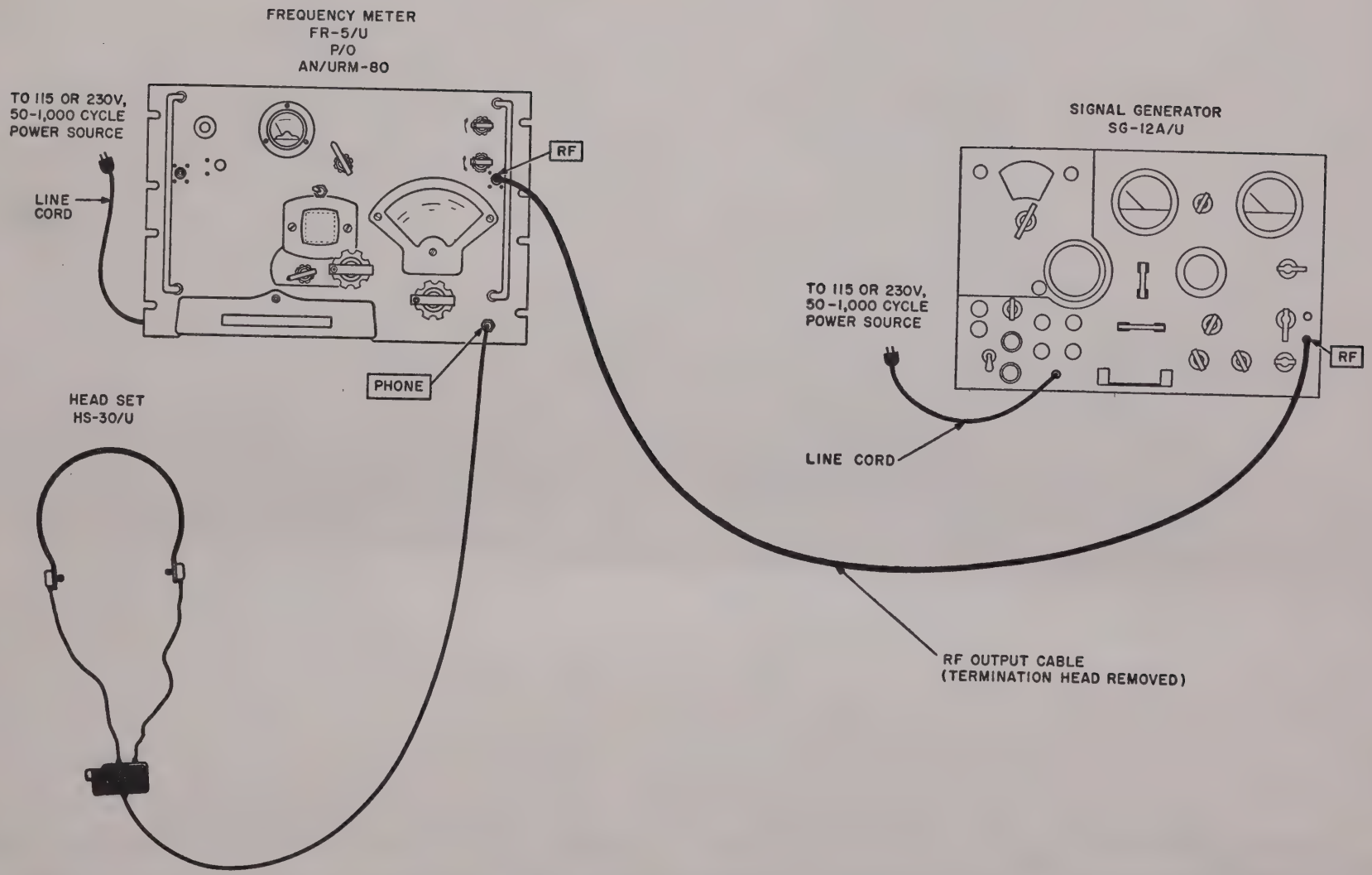


Figure 43.3. RF oscillator frequency calibration check.

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90.7. RF Oscillator Frequency Calibration Check

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.3. After turning on the AN/URM-80 and SG-12A/U

		CYCLES.		of the SG-12A/U is within 55.9832–56.0168 megacycles.
10	Same as step No. 8.	BAND SWITCH: Band D. RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG-12A/U is within 45.9862–46.0138 megacycles.
11	Same as step No. 8.	RF TUNING: 58 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG-12A/U is within 57.9826–58.0174 megacycles.
12	Same as step No. 8.	RF TUNING: 70 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG-12A/U is within 69.9790–70.0210 megacycles.
13	Same as step No. 8.	BAND SWITCH: Band E. RF TUNING: 66 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG-12A/U is within 65.9780–66.0220 megacycles.
14	Same as step No. 8.	RF TUNING: 84 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG-12A/U is within 83.9748–84.0252 megacycles.
15	Same as step No. 8.	RF TUNING: 100 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG-12A/U is within 99.9700–100.0300 megacycles.

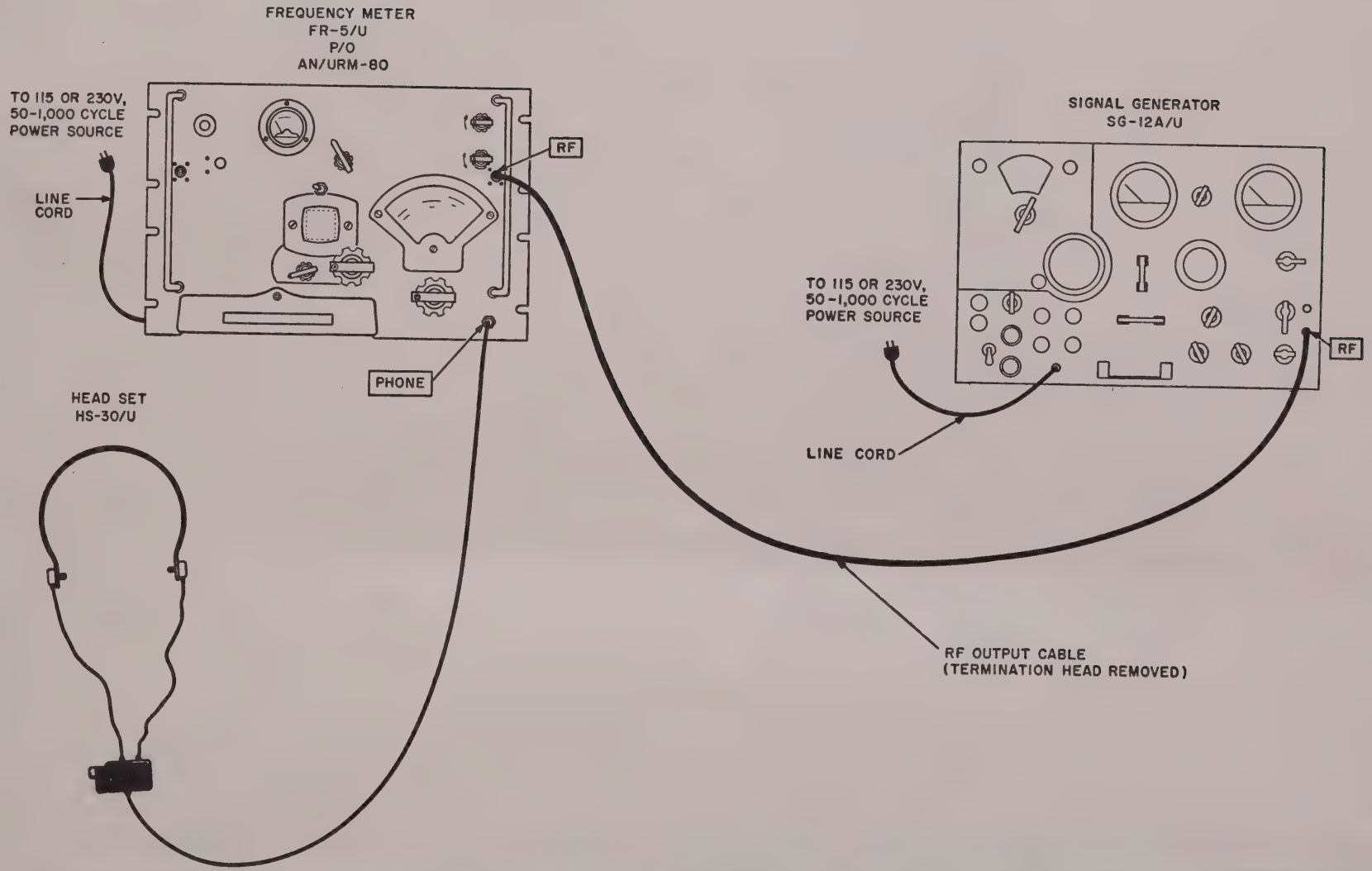

Figure 43.3. RF oscillator frequency calibration check.

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90.7. RF Oscillator Frequency Calibration Check

a. Test Equipment and Materials.
Frequency Meter AN/URM–80
Headset HS–30/U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.3 After turning on the AN/URM–80 and SG–12A/U, allow a minimum of 20-minute warm-up time before proceeding with the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*AN/URM–80* RANGE: 10–21.7 MC. FUNCTION SWITCH: COARSE. LEVEL control: Fully clockwise. POWER switch: ON (toggle switch to the right).	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES. RF ATTENUATOR MICROVOLTS: 10K. OPERATION: MOD OFF. POWER switch: ON.	*a.* Make the following preliminary adjustments of the SG–12A/U controls: (1) Adjust the RF SET TO LINE control for the SET TO LINE Indication on the IF MICROVOLTS, RF SET TO LINE meter. (2) Set the OPERATION switch to CAL. (3) Adjust the CORRECTOR control for a zero beat indication from the loudspeaker in the front panel. (4) Set the OPERATION switch to MOD OFF. *b.* Using the *instructions of unknown frequency* on page 23 of the AN/URM–80 calibration book, measure the frequency of SG–12A/U output.	*a.* None. *b.* The output frequency of the SG–12A/U is within 19.9940–20.0060 megacycles.
2	*AN/URM–80* RANGE: 21.7–46.7 MC. FUNCTION SWITCH: COARSE. LEVEL control: Fully clockwise. POWER switch: ON.	RF TUNING: 24 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 23.9928–24.0072 megacycles.
3	Same as step No. 2.	RF TUNING: 28 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 27.9916–28.0084 megacycles.
4	Same as step No. 2.	BAND SWITCH: Band B. RF TUNING: 27 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 26.9919–27.0081 megacycles.
5	Same as step No. 2.	RF TUNING: 33 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 32.9901–33.0099 megacycles.
6	Same as step No. 2.	RF TUNING: 39 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 38.9883–39.0117 megacycles.
7	Same as step No. 2.	BAND SWITCH: Band C. RF TUNING: 38 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 37.9886–38.0114 megacycles.
8	*AN/URM–80* RANGE: 46.7–100 MC. FUNCTION SWITCH: COARSE. LEVEL control: Fully clockwise. POWER switch: ON.	RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 46.9859–47.0141 megacycles.
9	Same as step No. 8.	RF TUNING: 56 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 55.9832–56.0168 megacycles.
10	Same as step No. 8.	BAND SWITCH: Band D. RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 45.9862–46.0138 megacycles.
11	Same as step No. 8.	RF TUNING: 58 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 57.9826–58.0174 megacycles.
12	Same as step No. 8.	RF TUNING: 70 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 69.9790–70.0210 megacycles.
13	Same as step No. 8.	BAND SWITCH: Band E. RF TUNING: 66 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 65.9780–66.0220 megacycles.
14	Same as step No. 8.	RF TUNING: 84 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 83.9748–84.0252 megacycles.
15	Same as step No. 8.	RF TUNING: 100 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 99.9700–100.0300 megacycles.

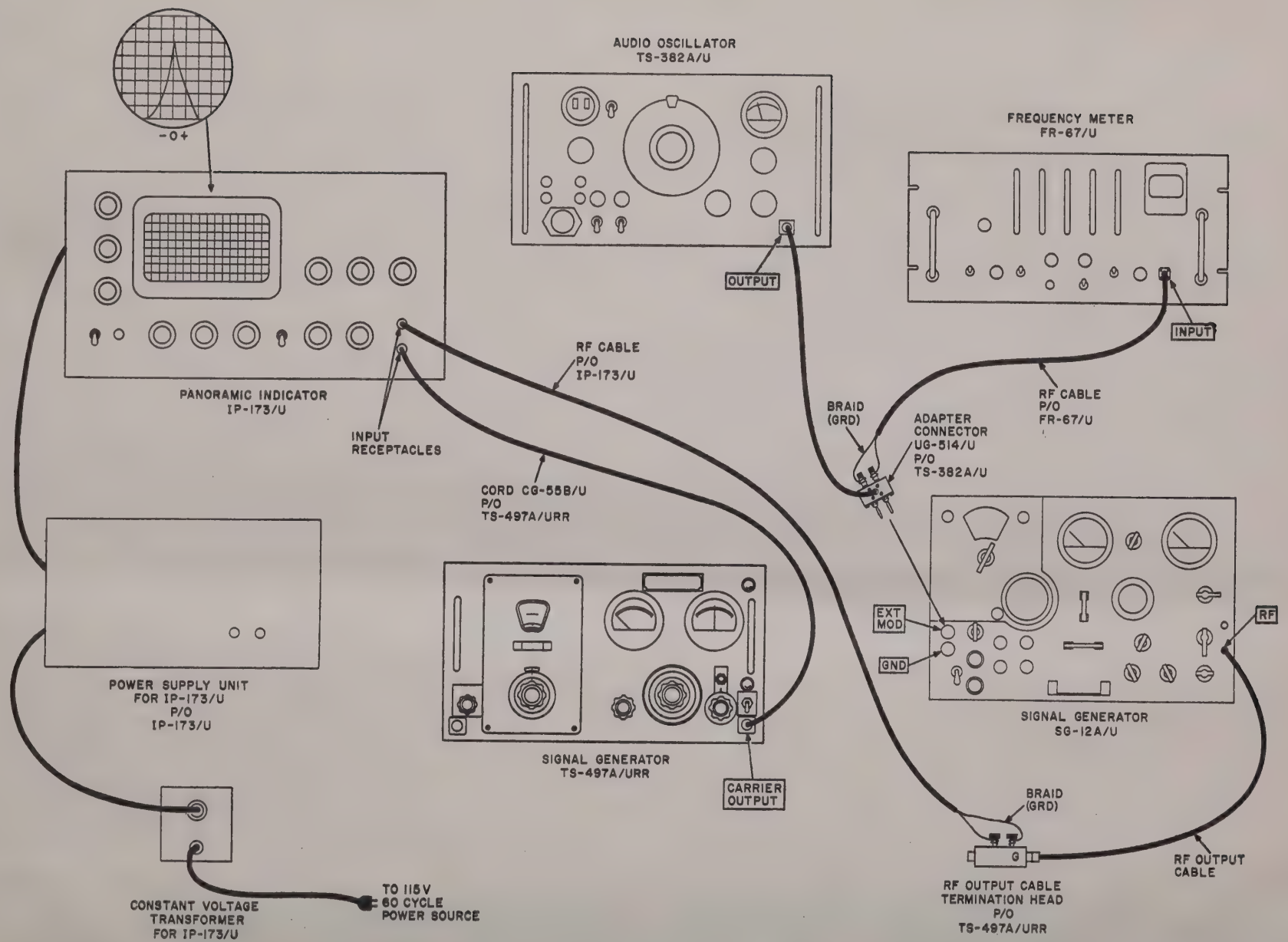

Figure 43.4. Frequency deviation test.

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90.8. Frequency Deviation Test

a. Test Equipment and Materials.
Panoramic Indicator IP–173/U
Audio Oscillator TS–382(A)/U
Signal Generator TS–497(A)/URR
Frequency Meter FR–67/U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.4.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IP–173/U* SWEEP RATE: SLOW *Note* Do not disturb any other controls.	BAND SWITCH: Band A. Fully counterclockwise.	*a.* Adjust the RF SET TO LINE control on SG–	*a.* None.
6	*TS–497A/URR* Tuning dial: 53 MEGACYCLES. *Note* Do not disturb any other controls.	BAND SWITCH: Band D. RF TUNING: 58 MEGACYCLES. DEVIATION LEVEL: Fully counterclockwise.	Repeat step No. 4*a* through *d*.	Same as step No. 3*b*.
7	*TS–497A/URR* Range knob: Band E. Tuning dial: 79 MEGACYCLES. *Note* Do not disturb any other controls.	BAND SWITCH: Band E. RF TUNING: 84 MEGACYCLES. DEVIATION LEVEL: Fully counterclockwise.	Repeat step No. 4*a* through *d*.	Same as step No. 3*b*.
8		OPERATION: 1000~. DEVIATION LEVEL: Fully counterclockwise.	Turn the DEVIATION LEVEL control on the SG–12A/U clockwise as far as it will go and note the indication on the KILOCYCLES DEVIATION meter.	The KILOCYCLES DEVIATION meter indicates not less than full scale.

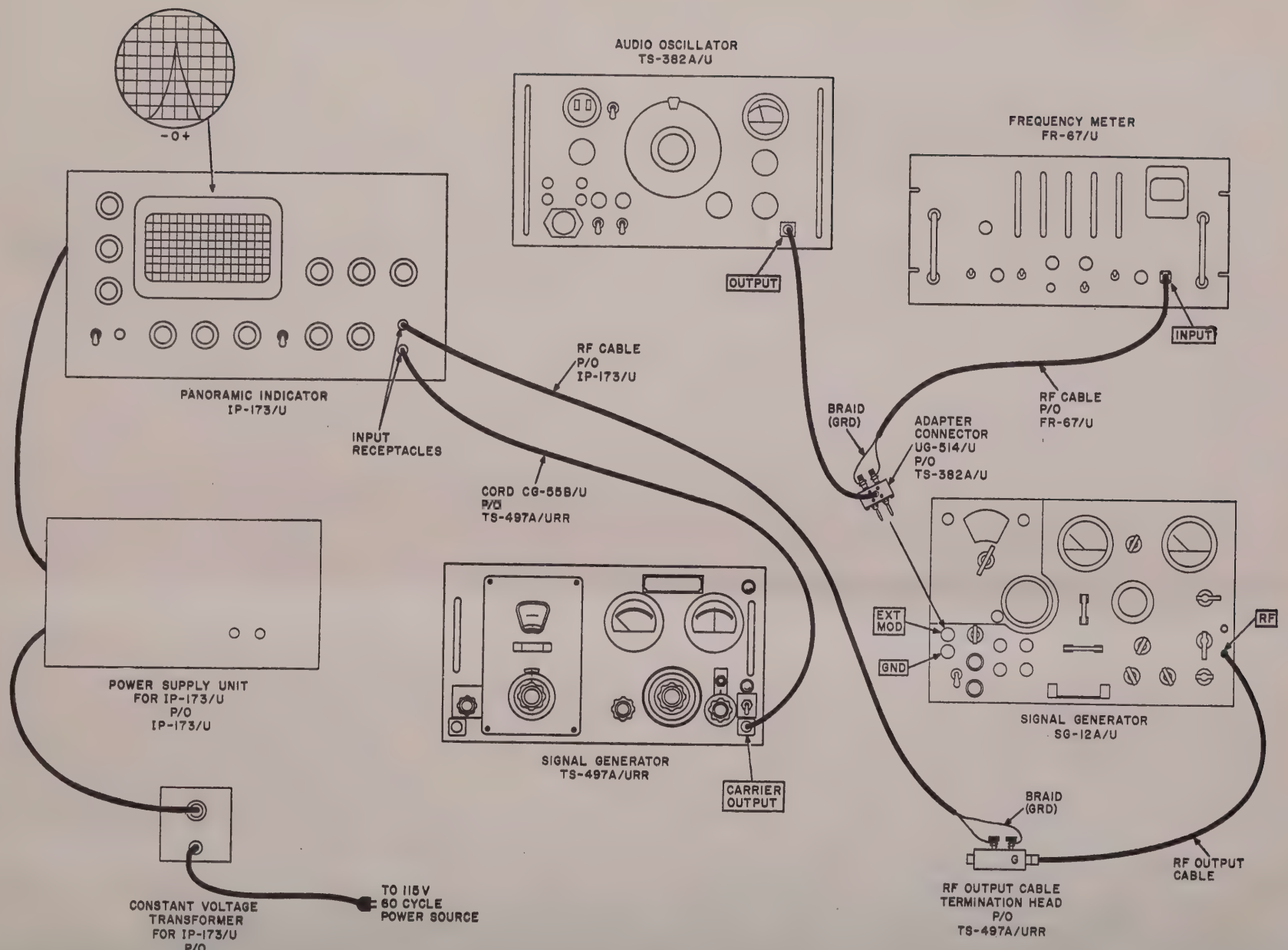

Figure 43.4. Frequency deviation test.

TM1257-C3-3

90.8. Frequency Deviation Test

a. Test Equipment and Materials.
Panoramic Indicator IP–173/U
Audio Oscillator TS–382(A)/U
Signal Generator TS–497(A)/URR
Frequency Meter FR–67/U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.4.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IP–173/U* SWEEP RATE SELECTOR: 30. SCALE SELECTOR: LIN. VIDEO FILTER: in (UP). INTENSIFIER: Fully counterclockwise. RESOLUTION: 0.1. SWEEP WIDTH: 0.1. CENTER FREQ: mid-position. GAIN: 5. POWER switch: ON. *TS–382A/U* RANGE SWITCH: X100. ATTENUATOR: 10. OUTPUT LEVEL control: Fully clockwise. Main tuning dial: 62.5. OSC: ON. *TS–497A/URR* Range knob; Band C. Tuning dial: 20 MEGACYCLES. Carrier output attenuator (MICROVOLTS): 30K. POWER switch: ON. *FR–67/U* MEASURE-CHECK switch: MEASURE. EXT. START-INT. START: INT. START. AUTO-MANUAL: AUTO. MULTIPLY FREQUENCY BY: 1. DISPLAY TIME: Fully counterclockwise. POWER switch: ON.	BAND SWITCH: Band A. RF TUNING: 25 MEGACYCLES. OPERATION: EXT MOD. DEVIATION RANGE: 25. DEVIATION LEVEL: Fully counterclockwise. RF ATTENUATOR MICROVOLTS: 10K. POWER switch: ON.	*a.* Adjust the RF SET TO LINE control on SG–12A/U for a red line indication on the IF MICROVOLTS, RF SET TO LINE meter. *b.* Adjust the ring fiducial on the TS–497A/URR for a SET TO RED LINE indication on the OUTPUT meter. *c.* Adjust the FR–67/U SENSITIVITY control until the INPUT LEVEL meter pointer lies in the green sector of the meter scale. *d.* Adjust the TS–382A/U main tuning dial in the vicinity of 62.5 until the FR–67/U meter displays a count of 6,250 ± cycle. *e.* Adjust the BRILLIANCE and FOCUS controls on the IP–173/U until a well defined trace extending across the bottom of the score face is seen. *f.* Adjust the tuning dial of TS–497A/URR and the GAIN control of the IP–173/U until a waveform similar to that shown in figure 43.4 appears on the IP–173/U scope face. *Note.* Slight adjustment of the IP–173/U SWEEP WIDTH and RESOLUTION controls may be necessary to achieve the desired results. *g.* While closely observing the waveform, slowly turn the DEVIATION LEVEL control on SG–12A/U clockwise until the waveform pip disappears for the first time (carrier null). Note the indication on the KILOCYCLES DEVIATION meter. *Note.* Disregard the sideband waveforms that appear at either side as the center frequency waveform diminishes in amplitude.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* None. *g.* The KILOCYCLES DEVIATION meter indicates within 12–18 kc on the 0–25 scale of KILOCYCLES DEVIATION meter.
2	*TS–382A/U* Main tuning dial: 46.4.	DEVIATION RANGE: 50. DEVIATION LEVEL: Fully counterclockwise. *Note.* Do not disturb other controls.	*a.* Adjust the audio oscillator main tuning dial in the vicinity of 46.4 until the FR–67/U displays a count of 4,640 ± 1 cycle. *b.* While closely observing the waveforms on the scope face of the IP–173/U, slowly turn the deviation level control on, SG–12A/U clockwise until the waveform disappears (carrier nulls) for the *third time*.	*a.* None. *b.* The KILOCYCLES DEVIATION meter indicates within 32–48 kc on the 0–50 scale of the KILOCYCLE DEVIATION meter.
3	*TS–382A/U* Main tuning dial: 35.4.	DEVIATION RANGE: 100. DEVIATION LEVEL: Fully counterclockwise.	*a.* Adjust the audio oscillator main tuning dial in the vicinity of 35.4 until the FR–67/U displays a count of 3,537 ± 1 cycle. *b.* While closely observing the waveform on the scope face of the IP–173/U, slowly turn the DEVIATION LEVEL control on the SG–12A/U clockwise until the waveform disappears (carrier nulls) for the *seventh* time.	*a.* None. *b.* The KILOCYCLES DEVIATION meter indicates within 60–90 kc on the 0–100 scale of the KILOCYCLE DEVIATION meter.
4	*TS–497A/URR* Tuning dial: 28 MEGACYCLES. *Note.* Do not disturb any other controls.	BAND SWITCH: Band B. RF TUNING: 33 MEGACYCLES. DEVIATION LEVEL: Fully counterclockwise.	*a.* Adjust the RF SET TO LINE control on the SG–12A/U for a red line indication on its IF MICROVOLTS, RF SET TO LINE meter. *b.* Adjust the ring fiducial on the TS–497A/URR for a red line indication on its OUTPUT meter. *c.* Adjust the tuning dial of the TS–497A/URR until a waveform similar to that shown in figure 43.4 appears on the IP–173/U scope face. *d.* While closely observing the waveform on the scope face of the IP–173/U, slowly turn the DEVIATION LEVEL control on the SG–12A/U clockwise until the waveform disappears (carrier nulls) for the *seventh* time.	*a.* None. *b.* None. *c.* None. *d.* Same as step No. 3*b*.
5	*TS–497A/URR* Range knob: Band D. Tuning dial: 40 MEGACYCLES. *Note.* Do not disturb any other controls.	*a.* BAND SWITCH: Band C. *b.* RF TUNING: 45 MEGACYCLES. *c.* DEVIATION LEVEL: Fully counterclockwise.	Repeat step No. 4*a* through *d*.	Same as step No. 3*b*.
6	*TS–497A/URR* Tuning dial: 53 MEGACYCLES. *Note.* Do not disturb any other controls.	BAND SWITCH: Band D. RF TUNING: 58 MEGACYCLES. DEVIATION LEVEL: Fully counterclockwise.	Repeat step No. 4*a* through *d*.	Same as step No. 3*b*.
7	*TS–497A/URR* Range knob: Band E. Tuning dial: 79 MEGACYCLES. *Note.* Do not disturb any other controls.	BAND SWITCH: Band E. RF TUNING: 84 MEGACYCLES. DEVIATION LEVEL: Fully counterclockwise.	Repeat step No. 4*a* through *d*.	Same as step No. 3*b*.
8		OPERATION: 1000—. DEVIATION LEVEL: Fully counterclockwise.	Turn the DEVIATION LEVEL control on the SG–12A/U clockwise as far as it will go and note the indication on the KILOCYCLES DEVIATION meter.	The KILOCYCLES DEVIATION meter indicates not less than full scale.

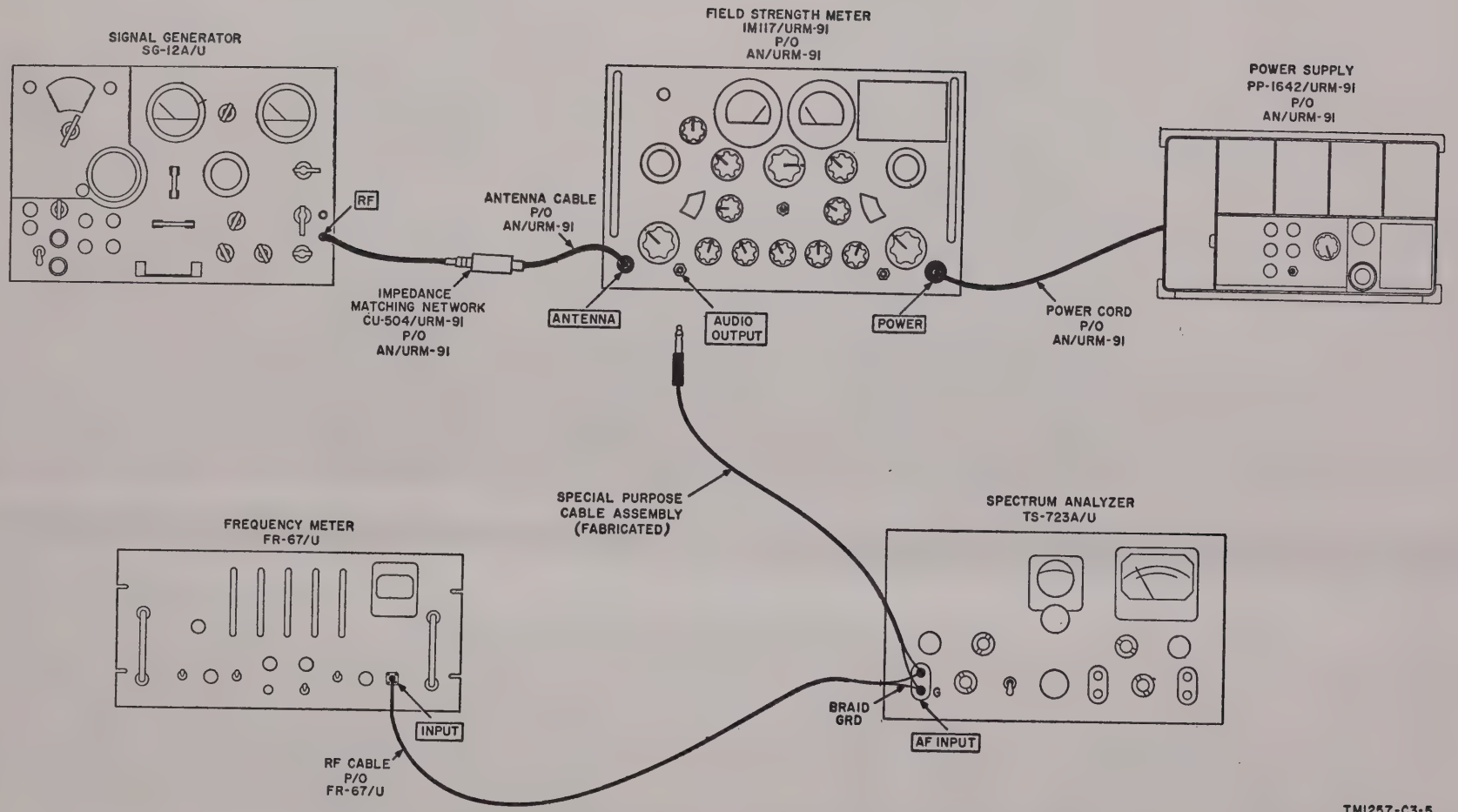

Figure 43.5. Modulation distortion and internal modulation frequency test.

			URM–91 GAIN control as required to keep the signal level meter pointer on scale.	
			d. Adjust the IM–117/URM–91 RF TRIMMER for a peak indication on the signal level meter.	*d.* None.
			e. Adjust the FR–67/U SENSITIVITY control until the pointer of the INPUT LEVEL meter lies in the green sector of the meter scale. Note the average count displayed.	*e.* The FR–67/U should indicate within 950–1,050 cycles.
Z	*Note.* Do not disturb any control settings except as indicated in the *Test procedure* column.	*Note.* Do not disturb any control settings.	*a.* Adjust the TS–723A/U signal INPUT control for a full scale indication on the panel meter (0–1.0 r.m.s. VOLTS scale).	*a.* None.
			b. Set the TS–723A/U function switch to DISTORTION and adjust the FREQUENCY controls (coarse and fine) for a minimum indication on the panel meter.	*b.* None.
			c. Adjust the TS–723A/U BALANCE control for a minimum indication on the panel meter; then note the panel meter indication (0–1.0 r.m.s. VOLTS scale).	*c.* The TS–723A/U panel meter should indicate not more than 0.05 (0–1.0 r.m.s. VOLTS scale) (5% distortion).

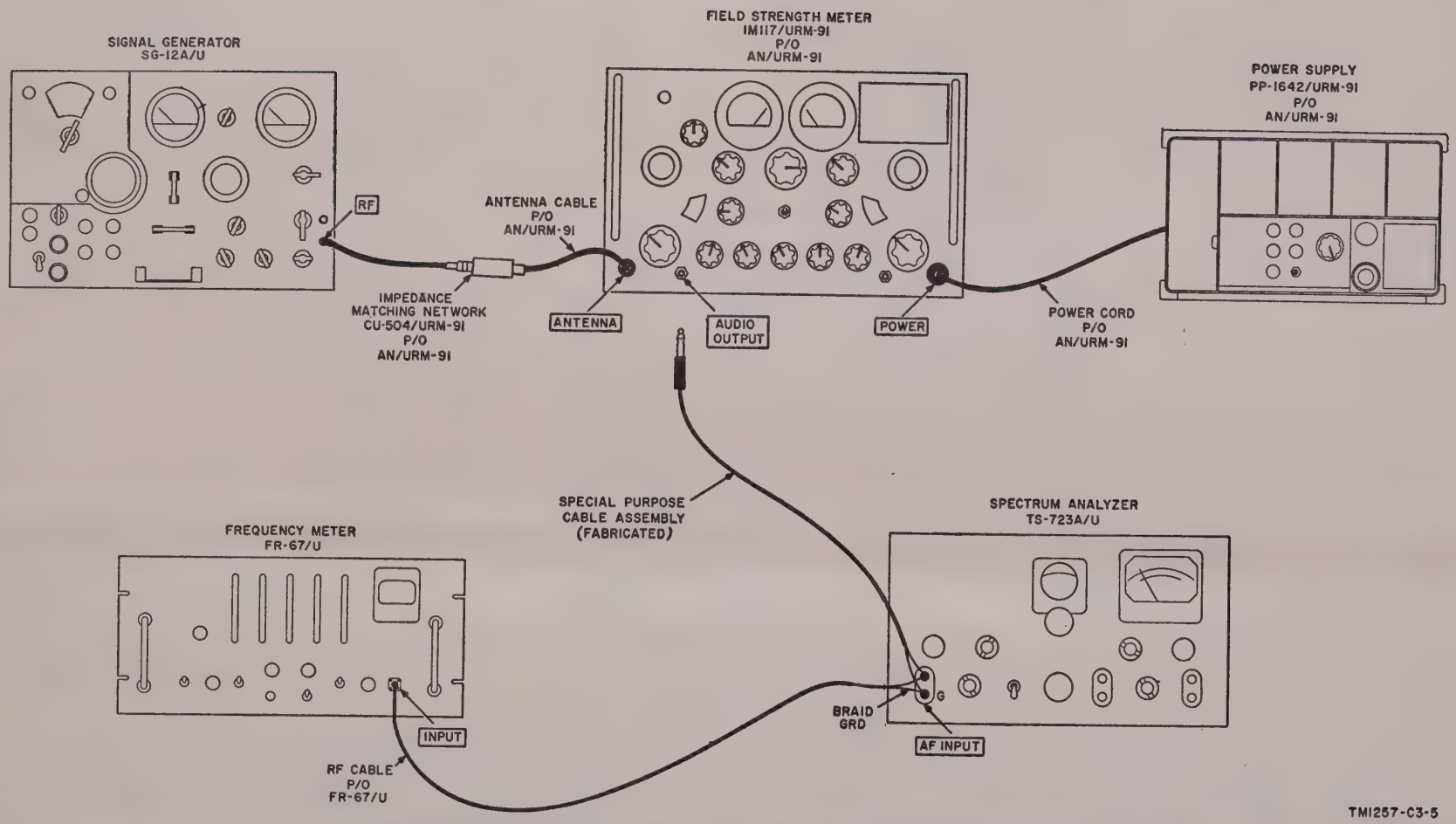

Figure 43.5. Modulation distortion and internal modulation frequency test.

90.9. Modulation Distortion and Internal Modulation Frequency Test

a. Test Equipment and Materials.

Field Strength Meter IM–117/URM–91 (p/o AN/URM–91) or TS–579/URR
Spectrum Analyzer TS–723(A)/U
Frequency Meter FR–67/U
Special purpose cable assembly (fabricated) (fig. 43.1)

b. Test Connection and Conditions.

(1) Connect the equipment as shown in figure 43.5.

(2) Place the TM–117/URM–91 power switch in START position and allow a 1-minute warmup period.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IM–117/URM–91* RECEIVER BAND SELECTOR: 18–35. RECEIVER FREQUENCY MEGACYCLES: 20. RESPONSE: BROAD. GAIN: 0. DB ATTENUATOR: 40. OUTPUT: LIN. CALIBRATE SWITCH: FIL. FM DISCRIMINATOR: ON. POWER switch: ON. *TS–723A/U* INPUT: MIN. AF–RF selector switch: AF. RANGE switch: X10. Function switch: SET LEVEL. Meter range switch: 100%. Power switch: ON. *FR–67/U* SENSITIVITY: Fully counterclockwise. MEASURE-CHECK: MEASURE. EXT. START-INT. START: INT. START. DISPLAY TIME: Fully counterclockwise. AUTO-MANUAL: AUTO. MULTIPLY FREQUENCY BY: 1. POWER switch: ON.	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES. OPERATION: 1000~. RF ATTENUATOR MICROVOLTS: 1K. DEVIATION RANGE: 100. POWER Switch: On.	*a.* Make the following preliminary adjustments of the SG–12A/U controls: (1) Adjust the DEVIATION LEVEL control for a full scale indication on the KILOCYCLES DEVIATION meter. (2) Adjust the RF SET TO LINE control for a red line indication on the IF MICROVOLTS, RF SET TO LINE meter.	*a.* None.
			b. Make the following preliminary adjustments of the IM–117/URM–91 (or TS–579/U) controls. *Note.* If the TS–579/U is used in place of the IM–117/URM–91, corresponding controls and indicators are to be used. (1) Adjust the VOLTAGE ADJUSTMENT control on Power Supply PP–1642/URM–91 for a red line indication on the calibration meter. (2) Push the ZERO toggle switch down and adjust the ZERO START control for a zero indication on the signal level meter (MICROVOLTS scale). (3) While still holding the ZERO toggle switch down, turn the POWER switch knob to ON position and adjust the ZERO ON control for a zero indication on the signal level meter (MICROVOLTS scale). (4) Release the ZERO toggle switch and turn the CALIBRATE SWITCH knob to the OFF position.	*b.* None.
			c. Set the IM–117/URM–91 meter GAIN control to 5 and adjust the RECEIVER FREQUENCY MEGACYCLES control for a peak indication on signal level meter. *Note.* Adjust the IM–117/URM–91 GAIN control as required to keep the signal level meter pointer on scale.	*c.* None.
			d. Adjust the IM–117/URM–91 RF TRIMMER for a peak indication on the signal level meter.	*d.* None.
			e. Adjust the FR–67/U SENSITIVITY control until the pointer of the INPUT LEVEL meter lies in the green sector of the meter scale. Note the average count displayed.	*e.* The FR–67/U should indicate within 950–1,050 cycles.
2	*Note.* Do not disturb any control settings except as indicated in the *Test procedure* column.	*Note.* Do not disturb any control settings.	*a.* Adjust the TS–723A/U signal INPUT control for a full scale indication on the panel meter (0–1.0 r.m.s. VOLTS scale).	*a.* None.
			b. Set the TS–723A/U function switch to DISTORTION and adjust the FREQUENCY controls (coarse and fine) for a minimum indication on the panel meter.	*b.* None.
			c. Adjust the TS–723A/U BALANCE control for a minimum indication on the panel meter; then note the panel meter indication (0–1.0 r.m.s. VOLTS scale).	*c.* The TS–723A/U panel meter should indicate not more than 0.05 (0–1.0 r.m.s. VOLTS scale) (5% distortion).

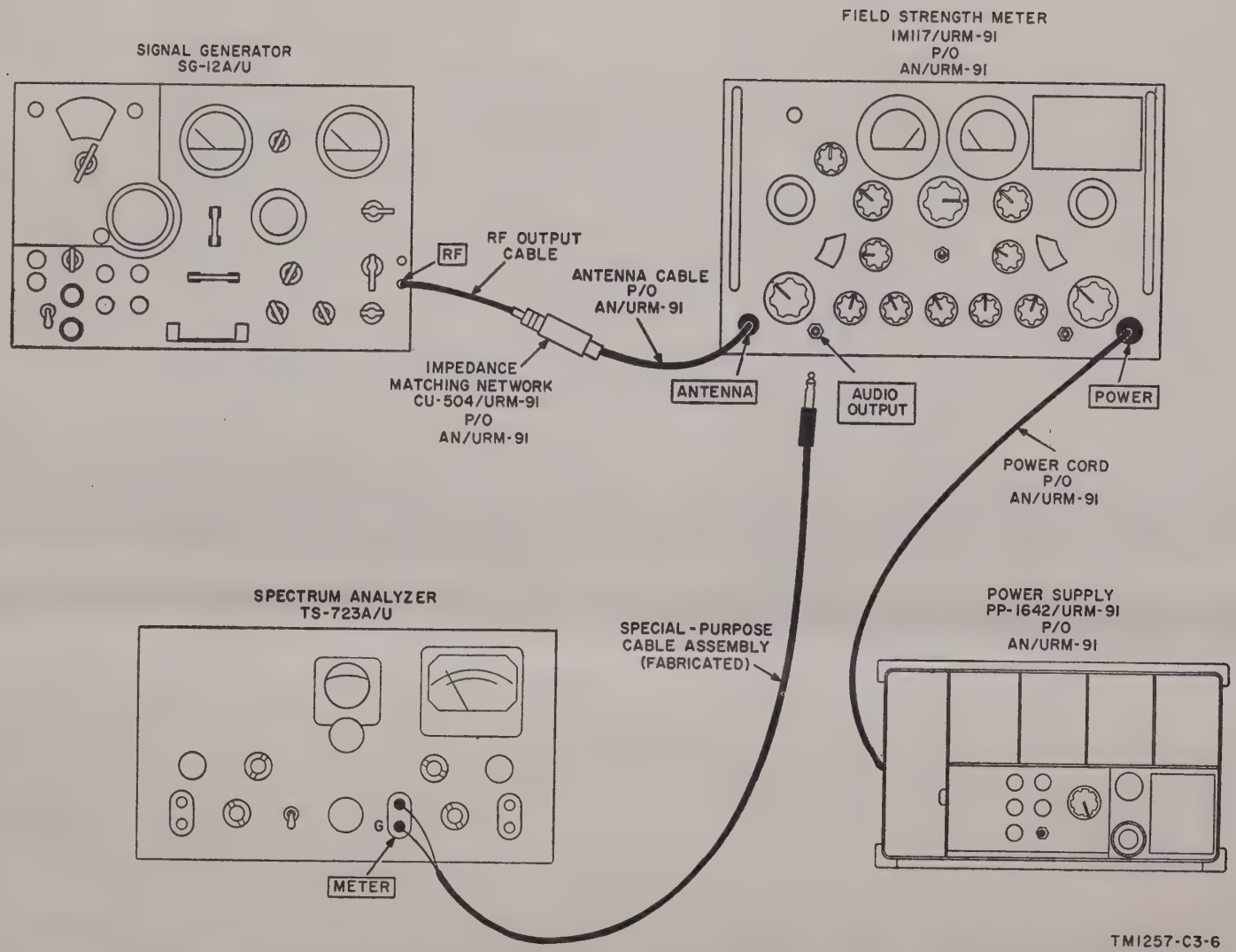

Figure 43.6. Noise test.

90.10. Noise Test

a. Test Equipment and Materials. Field Strength Meter IM–117/URM–91 (p/o AN/URM–91) or TS–579/U

Spectrum Analyzer TS–723A/U

Special purpose cable assembly (fabricated) (fig. 43.1)

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.6.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IM–117/URM–91*	BAND SWITCH: Band A.	*a.* Make the following preliminary adjustments of meter.	*a.* None.
			Note. Adjust the GAIN control as required to keep the signal level meter pointer on scale.	
			d. Adjust the IM–117/URM–91 RF TRIMMER for a peak indication on the signal level meter.	*d.* None.
			e. Adjust the IM–117/URM–91 GAIN control for a zero indication on the TS–723A/U panel meter DECIBELS scale.	*e.* None.
			f. Set the SG–12A/U OPERATION switch to MOD OFF and the TS–723A/U meter range switch to —30 DB. Note the indication on the TS–723A/U panel meter.	*f.* The TS–723A/U panel meter should indicate 0 or to the left of 0 on the scale (at least –50 DB).

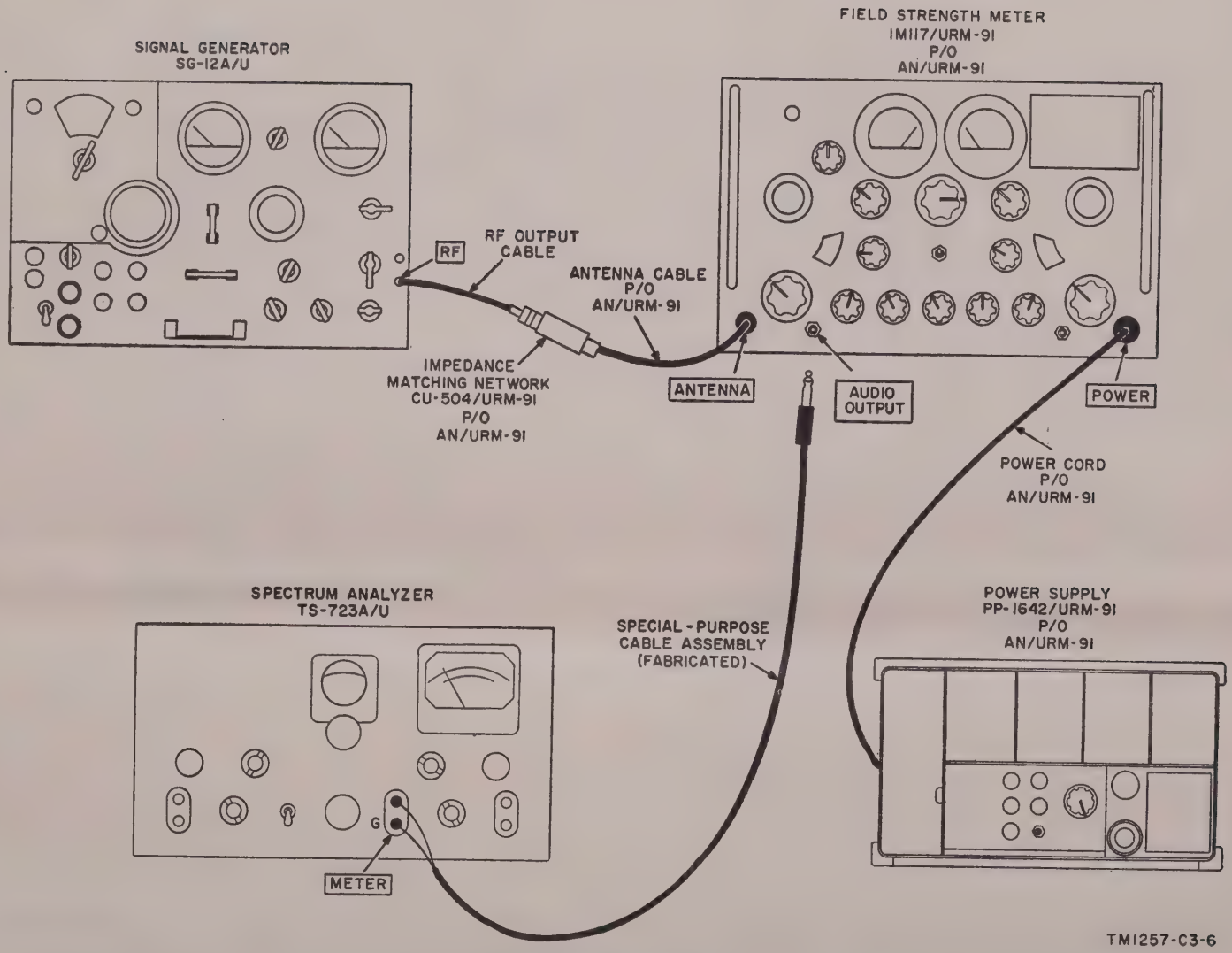

Figure 43.6. Noise test.

90.10. Noise Test

a. Test Equipment and Materials. Field Strength Meter IM–117/URM–91 (p/o AN/URM–91) or TS–579/U

Spectrum Analyzer TS–723A/U

Special purpose cable assembly (fabricated) (fig. 43.1)

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.6.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IM–117/URM–91* *Note.* If the TS–579/U is used in place of the IM–117/URM–91, corresponding controls and indicators are to be used. RECEIVER BAND SELECTOR: 18–35. RECEIVER FREQUENCY MEGACYCLES: 20. RESPONSE: SHARP. GAIN: 0. OUTPUT: LIN. DB ATTENUATOR: 40. CALIBRATE SWITCH: FIL. FM DISCRIMINATOR: ON. POWER: switch: START. *TS–723A/U* Function switch: METER. Meter range switch +20 DB.	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES. OPERATION: 1000~. RF ATTENUATOR MICROVOLTS: 10K. DEVIATION RANGE: 25. POWER switch: ON.	*a.* Make the following preliminary adjustments of the SG–12A/U controls: (1) Adjust the DEVIATION LEVEL control for an indication of 15 on the KILOCYCLES DEVIATION meter (0–25 scale). (2) Adjust the RF SET TO LINE control for a red line indication on the IF MICROVOLTS, RF SET TO LINE meter.	*a.* None.
			b. Make the following preliminary adjustment of the IM–117/URM–91 meter controls: (1) Adjust the VOLTAGE control on the Power Supply PP–1642/URM–91 for a red line indication on the calibration meter. (2) Push the ZERO toggle switch down and adjust the ZERO START control for a zero indication on the signal level meter (MICROVOLTS scale). (3) While still holding the ZERO toggle switch down, turn the POWER switch knob to the ON position and adjust the ZERO ON control for zero indication on the signal level meter (MICROVOLTS scale). (4) Release the ZERO toggle switch and turn the CALIBRATE SWITCH knob to the OFF position.	*b.* None .
			c. Set the IM–117/URM–91 GAIN control to 5 and adjust the RECEIVER FREQUENCY MEGACYCLES control for a peak indication on the signal level meter. *Note.* Adjust the GAIN control as required to keep the signal level meter pointer on scale.	*c.* None.
			d. Adjust the IM–117/-URM–91 RF TRIMMER for a peak indication on the signal level meter.	*d.* None.
			e. Adjust the IM–117/-URM–91 GAIN control for a zero indication on the TS–723A/U panel meter DECIBELS scale.	*e.* None.
			f. Set the SG–12A/U OPERATION switch to MOD OFF and the TS–723A/U meter range switch to —30 DB. Note the indication on the TS–723A/U panel meter.	*f.* The TS–723A/U panel meter should indicate 0 or to the left of 0 on the scale (at least –50 DB).

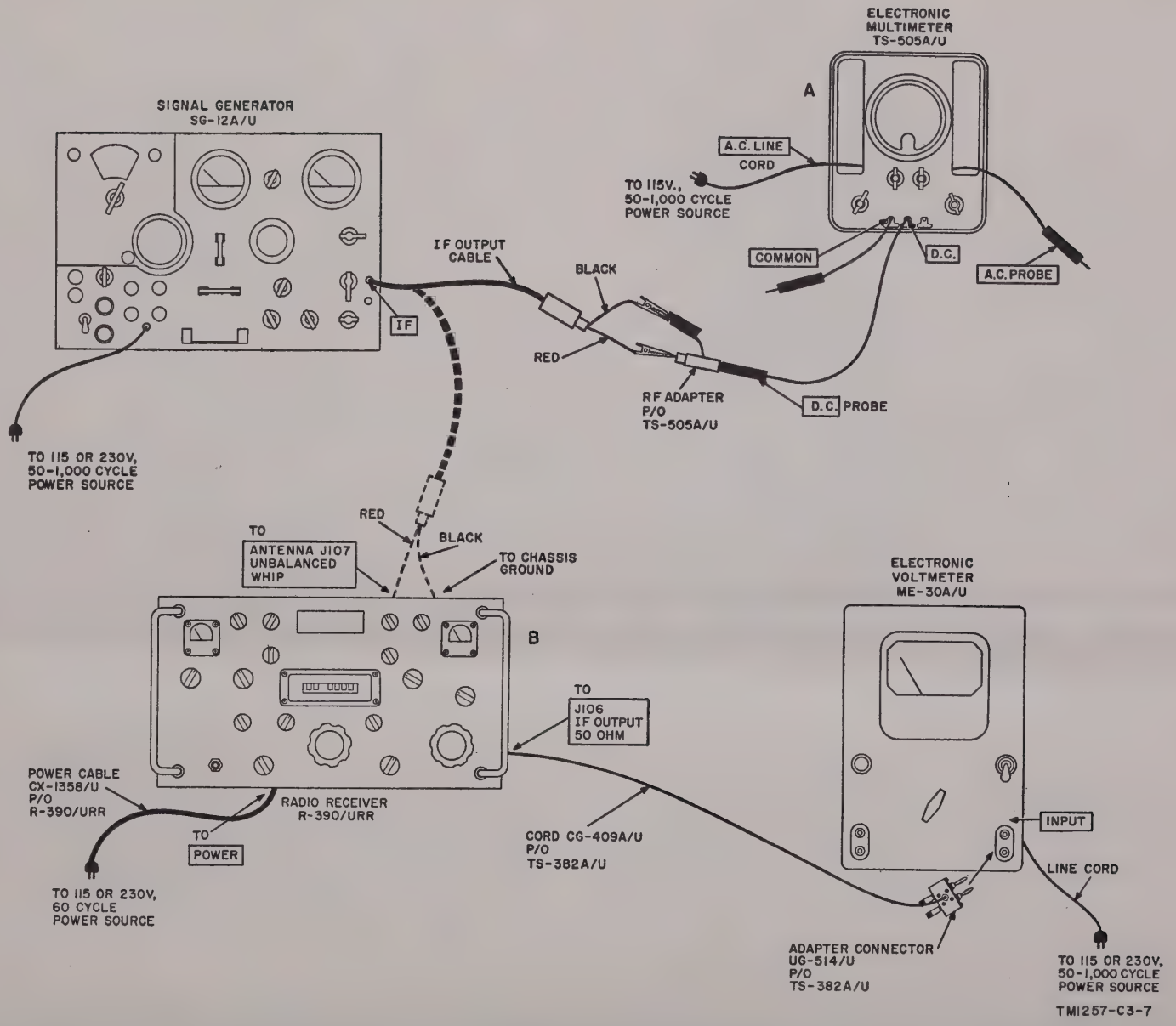

Figure 43.7. IF oscillator output and attenuator test.

14	Same as step No. 12 above.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter. *b.* Set the SG–12A/U IF MICROVOLTS switch to 100 and the ME–30A/U range switch to —30 DB. Note the indication on the ME–30A/U meter.	*a.* None. *b.* Same as step No. 11*f*.
15	Same as step No. 12 above.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter. *b.* Set the SG–12A/U IF MICROVOLTS switch to 10 and the ME–30A/U range switch to —30 DB. Note the indication on the ME–30A/U meter.	*a.* None. *b.* Same as step No. 11*f*.

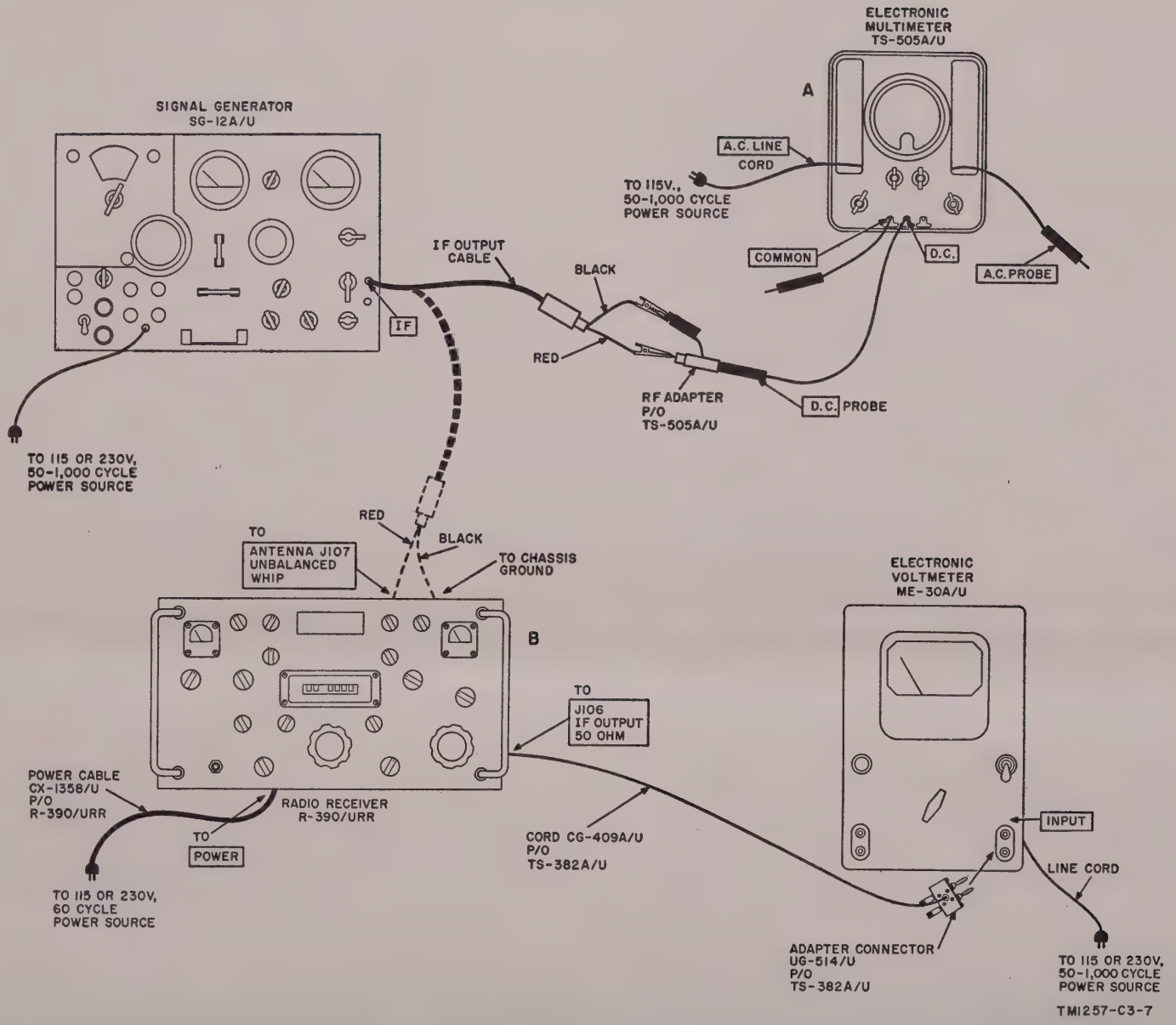

Figure 43.7. IF oscillator output and attenuator test.

90.11. IF Oscillator Output and Attenuator Test

a. Test Equipment and Materials.
Electronic Multimeter TS–505A/U
Electronic Voltmeter ME–30A/U

b. Test Connections and Conditions. Do not connect either meter or Radio Receiver (fig. 43.7) to the SG–12A/U output until instructed to do so in the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS–505A/U* FUNCTION switch: +dc RANGE switch: 2.5V RXI.	OPERATION: IF. IF MICROVOLTS: 1.0 VOLT. IF FREQUENCY MC: 1.37. POWER switch: ON.	*a.* Zero the TS–505A/U as follows: Short the dc and COMMON probe tips together and adjust the ZERO ADJ. control until the meter pointer indicates exactly 0 volt.	*a.* None.
			b. Separate the dc and COMMON probe tips and connect the TS–505A/U to the SG–12A/U output as shown in A, figure 43.7.	*b.* None.
			c. Adjust the SG–12A/U IF LEVEL control for an indication of 10 on the IF MICROVOLTS, RF SET TO LINE meter. Note the indication on the TS–505A/U.	*c.* TS–505A/U indicates within .75–1.25 volts.
2	Same as step No. 1.	IF FREQUENCY MC: 1.40.	Repeat step No. 1*c*.	Same as step No. 1*c*.
3	Same as step No. 1.	IF FREQUENCY MC: 1.43.	Repeat step No. 1*c*.	Same as step No. 1*c*.
4	Same as step No. 1.	IF FREQUENCY MC: 4 4.27.	Repeat step No. 1*c*.	Same as step No. 1*c*.
5	Same as step No. 1.	IF FREQUENCY MC: 4.30.	Repeat step No. 1*c*.	Same as step No. 1*c*.
6	Same as step No. 1.	IF FREQUENCY MC: 4.33.	Repeat step No. 1*c*.	Same as step No. 1*c*.
7	Same as step No. 1.	IF FREQUENCY MC: 4.45.	Repeat step No. 1*c*.	Same as step No. 1*c*.
8	Same as step No. 1.	IF FREQUENCY MC: 5.00.	Repeat step No. 1*c*.	Same as step No. 1*c*.
9	Same as step No. 1.	IF FREQUENCY MC: 5.35.	Repeat step No. 1*c*.	Same as step No. 1*c*.
10	Same as step No. 1.	IF FREQUENCY MC: 15.	Repeat step No. 1*c*.	Same as step No. 1*c*.
11	*ME–30A/U* Range selector switch: +10DB. POWER switch: ON. *R–390/URR* FUNCTION: MGC. BREAK IN: OFF. BFO: OFF. BANDWIDTH KC: 1. LIMITER: OFF. MEGACYCLE CHANGE: 01. KILOCYCLE CHANGE: 370. LOCAL GAIN: 0. RF GAIN: 3.	IF FREQUENCY MC: 1.37. IF MICROVOLTS: 1.0 volt. OPERATION: IF. POWER switch: ON.	*a.* Reconnect the equipment as shown in B, figure 43.7.	*a.* None.
			b. Adjust the SG–12A/U IF LEVEL control for an indication of 10 on the IF MICROVOLTS, RF SET TO LINE meter.	*b.* None.
			c. Adjust the R–390/URR MEGACYCLES CHANGE control for a peak indication on the ME–30A/U meter. *Note.* If the meter pointer runs off scale, reduce the setting of the R–390/URR RF GAIN control to achieve midscale indication.	*c.* None.
			d. Adjust the R–390/URR ANT TRIM +control for a peak indication on the ME–30A/U.	*d.* None.
			e. Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter.	*e.* None.
			f. Set the SG–12A/U IF MICROVOLTS switch to 100K and the ME–30A/U range switch to −30DB. Note the indication on the ME–30A/U meter.	*f.* The ME–30A/U meter indicates 0 +1 on the DECIBELS scale.
12	*ME–30A/U* Range selector switch: −10DB.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter.	*a.* None.
			b. Set the SG–12A/U IF MICROVOLTS switch to 10K and the ME–30A/U range switch to −30 DB. Note the indication on the ME–30A/U meter.	*b.* Same as step No. 11*f*.
13	Same as step No. 12 above.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter.	*a.* None.
			b. Set the SG–12A/U IF MICROVOLTS switch to 1K and the ME–30A/U range switch to −30 DB. Note the indication on the ME–30A/U meter.	*b.* Same as step No. 11*f* above.
14	Same as step No. 12 above.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter.	*a.* None.
			b. Set the SG–12A/U IF MICROVOLTS switch to 100 and the ME–30A/U range switch to −30 DB. Note the indication on the ME–30A/U meter.	*b.* Same as step No. 11*f*.
15	Same as step No. 12 above.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A U meter.	*a.* None.
			b. Set the SG–12A/U IF MICROVOLTS switch to 10 and the ME–30A/U range switch to −30 DB. Note the indication on the ME–30A U meter.	*b.* Same as step No. 11*f*.

1	TS-505A/U FUNCTION switch: +dc RANGE switch: 2.5V RXI.	OPERATION: IF. IF MICROVOLTS: 1.0 VOLT. IF FREQUENCY MC: 1.37. POWER switch: ON.	a. Zero, the TS-505A/U [illegible] control until the meter pointer indicates exactly 0 volt. [illegible] 505A/U to the SC-12A/U output as shown in A. figure 43.7. [illegible] 12A/U [illegible] for [illegible] SET TO LINE [illegible]	a. None. b. None. c. TS-505A/U indicates within .75-1.25 [illegible]

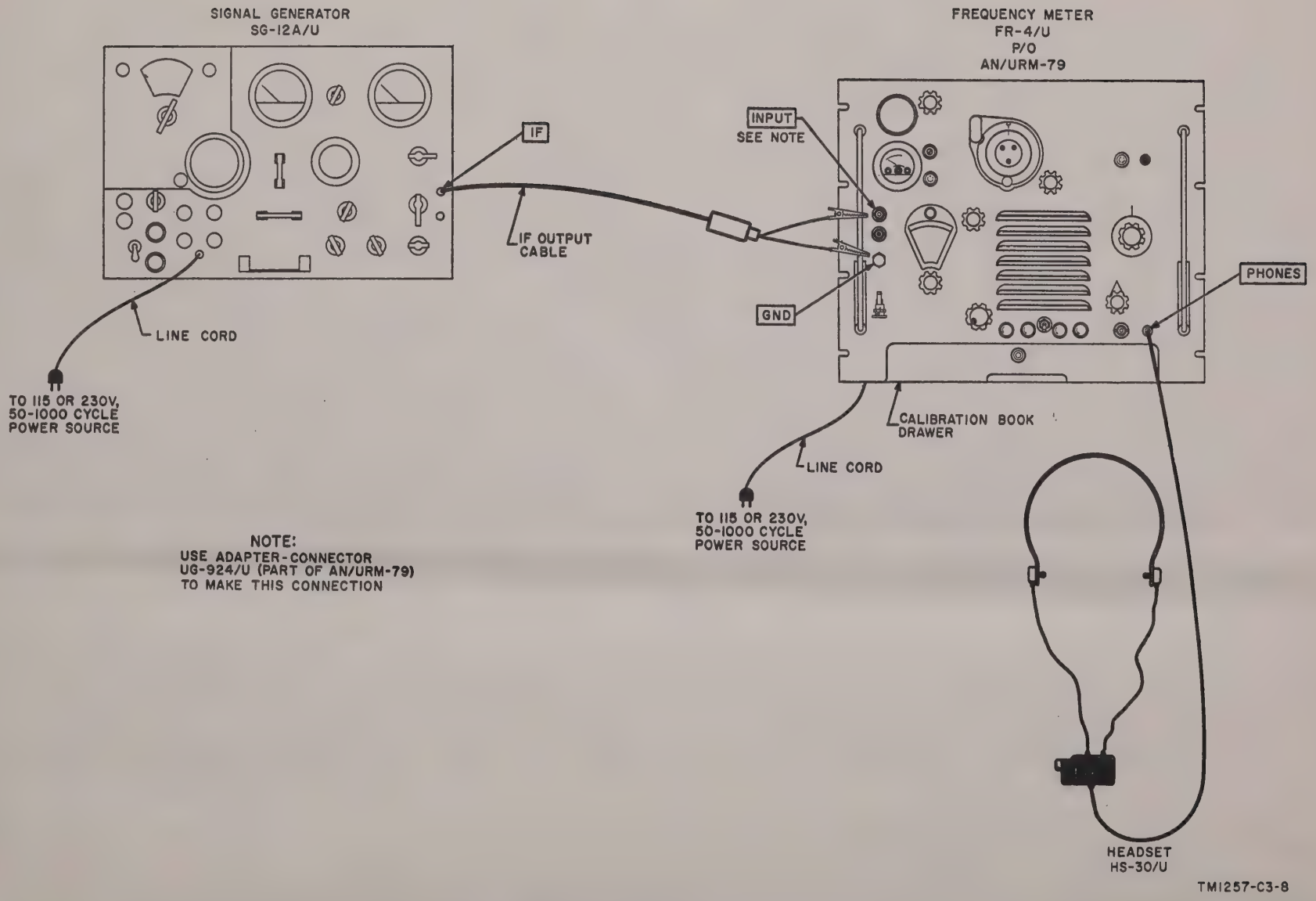

Figure 43.8. IF oscillator frequency calibration check.

90.12. IF Oscillator Frequency Calibration Check

a. Test Equipment and Materials.

Frequency Meter FR–4/U (p/o AN/URM–79)

Headset HS–30/U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.8. After turning on the FR–4/U (p/o AN/URM–79), allow at least a 20-minute warmup time before proceeding with the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*FR–4/U*	OPERATION: IF.	*a.* Adjust the SG–12A/U IF LEVEL control for	*a.* None.
9	*FR–4/U* BAND SWITCH: Band 6. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 5.35.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 5,349,-723 – 5,350,268 cycles.
10	*FR–4/U* BAND SWITCH: Band 7. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 15.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within the 14,-999,250 – 15,000,750 cycles.

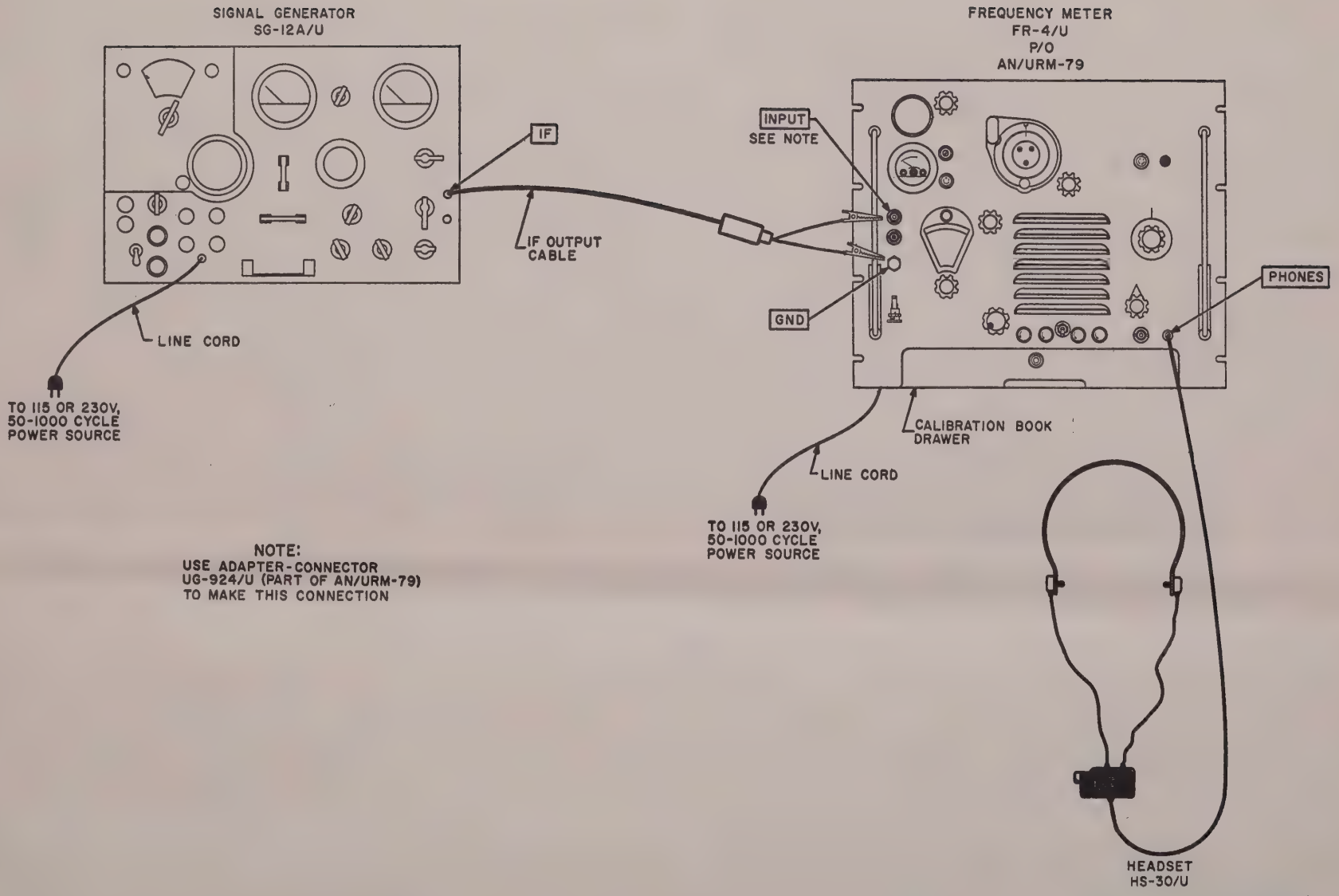

Figure 43.8. IF oscillator frequency calibration check.

90.12. IF Oscillator Frequency Calibration Check

a. Test Equipment and Materials.

Frequency Meter FR–4/U (p/o AN/URM–79)

Headset HS–30/U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.8. After turning on the FR–4/U (p/o AN/URM–79), allow at least a 20-minute warmup time before proceeding with the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*FR–4/U* BAND SWITCH: Band 4. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	OPERATION: IF. IF FREQUENCY MC: 1.37. IF MICROVOLTS: 1K. POWER switch: ON.	*a.* Adjust the SG–12A/U IF LEVEL control for an indication of 10 on the IF MICROVOLTS, RF SET TO LINE meter. *b.* Using the operating procedure on page 23 of the FR–4/U (p/o AN/URM–79) calibration book, measure the frequency of the SG–12A/U output.	*a.* None. *b.* The output frequency of the SG–12A/U is within 1,369,931 – 1,370,069 cycles.
2	Same as step No. 1.	IF FREQUENCY MC: 1.40.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 1,399,931–1,400,070 cycles.
3	Same as step No. 1.	IF FREQUENCY MC: 1.43.	Repeat step No. 1*a* and *b*.	The frequency of the SG–12A/U is within 1,429,927–1,430-073 cycles.
4	*FR–4/U* BAND SWITCH: Band 5. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 4.27.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,269,786–4,270,214 cycles.
5	Same as step No. 4.	IF FREQUENCY MC: 4.30.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,299,785–4,300,215 cycles.
6	Same as step No. 4.	IF FREQUENCY MC: 4.33.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,329,783–4,330,217 cycles.
7	Same as step No. 4.	IF FREQUENCY MC: 4.45.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,449,777–4,450,223 cycles.
8	Same as step No. 4.	IF FREQUENCY MC: 5.00.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,999,750–5,000,250 cycles.
9	*FR–4/U* BAND SWITCH: Band 6. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 5.35.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 5,349,-723 – 5,350,268 cycles.
10	*FR–4/U* BAND SWITCH: Band 7. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 15.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within the 14,-999,250 – 15,000,750 cycles.

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.8. After turning on the FR-4/U (p/o AN/[illegible]) allow at least a 20-minute warmup [illegible]

	4. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	1.37. IF MICROVOLTS: 1K. POWER switch: ON.	the IF MICROVOLTS, RF SET TO LINE meter. b. Using the operating procedure on page 23 of the FR-4/U (p/o [illegible] tion book, measure the frequency of the SG-12A/U output.	b. The output frequency of the SG-12A/U is within [illegible] cycles.
2	Same as step No. 1.	IF FREQUENCY MC: 1.40.	Repeat step No. 1a and b.	
3	Same as step No. 1.	IF FREQUENCY MC: 1.43.	Repeat step No. 1a and b.	
4	FR-4/U BAND SWITCH: Band 5 FUNCTION SW:	IF FREQUENCY MC: 4.27.	Repeat step No. 1a and b.	The output frequency of the SG-12A/U is within 4,269,786-4,270,214 cycles.

90.13. Performance Standards Summary

	Performance standard
a. RF output test.	0.05 milliwatts ± 25% (all bands).
b. RF oscillator frequency calibration check.	±0.03%.
c. Frequency deviation test (modulation).	
(1) Band A (25 mc).	
(*a*) 25-kc deviation range.	15 ± 3 kc.
(*b*) 50-kc deviation range.	40 ± 8 kc.
(*c*) 100-kc deviation range.	75 ± 15 kc.
(2) Bands B, C, D and E (100-kc deviation range only).	75 ± 15 kc.
d. Modulation distortion and internal Modulation frequency test.	
(1) Modulation distortion.	5% max.
(2) Internal modulation frequency.	1,000 cycles ±5%.
e. Noise test.	—50 db down.
f. If oscillator output and attenuator test.	
(1) Output (1-volt settings all frequencies).	1 volt ±25%.
(2) Attenuator.	20 ± 1 db change each step.
g. If oscillator frequency calibration check	—0.005% (each frequency).

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USAR: None.

For explanation of abbreviations used, see AR 320–50.

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TM 11–1257
*C 5

SIGNAL GENERATOR AN/URM–48

CHANGE
No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *21 October 1963*

TM 11–1257, 8 December 1953, is changed as follows:

Note. The parenthetical reference to a previous change (example: "page 5 of C 2") indicates that pertinent material was published in that change.

Page 7. Add paragraph 1.1 after paragraph 1.

1.1. Index of Publications

Refer to the latest issue of DA Pam 310–4 to determine whether there are new editions, changes, or additional publications pertaining to your equipment. DA Pam 310–4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (–10, –20, –35P, etc.) and the latest changes to and revisions of each equipment publication.

Delete paragraph 2 and substitute:

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38–750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71–4 (Air Force).

c. Reporting of Equipment Manual Improvements. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA technical manual parts lists or supply manual 7, 8, or 9) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS–MP, Fort Monmouth, N.J. 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc.).

Page 26. Delete section I (page 3 of C 2) and figures 10 and 11 and substitute:

Section I. PREVENTIVE MAINTENANCE SERVICES

30. Scope of Maintenance

The maintenance duties assigned to the operator and organizational repairman of the signal generator are listed below together with a reference to the paragraphs covering the specific maintenance functions. The special tools required are listed in TM 11–6625–267–12P.

a. Daily preventive maintenance checks and service (par. 33).

b. Weekly preventive maintenance checks and services (par. 34).

c. Monthly preventive maintenance checks and services (par. 34.1).

d. Quarterly preventive maintenance checks and services (par. 34.2).

e. Cleaning (par. 34.3).

f. Touchup painting (par. 34.4).

g. Lubrication (pars. 35–38).

* This change replaces Repaired Equipment Standard No. REP–661, Issue No. 1, 17 September 1954, and supersedes C 4, TM 11–1257, 30 January 1963.

h. Troubleshooting (pars. 41–44).

i. Repairs.

(1) Fuses and lamps (figs. 2 and 7).

(2) Tubes (fig. 5).

31. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 33 through 34.4 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (pars. 33–34.2) outline functions to be performed at specific intervals. These checks and services are to maintain army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the chart indicates what to check, how to check, and what the normal conditions are. The *References* column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective actions listed, higher echelon maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38–750.

32. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the signal generator are required daily, weekly, monthly, and quarterly.

a. Paragraph 33 specifies the checks and services that must be accomplished daily (or at least once each week if the equipment is maintained in standby condition).

b. Paragraphs 34, 34.1, and 34.2 specify *additional* checks and services that must be performed on a weekly, monthly, and quarterly basis, respectively.

33. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Completeness	See that the equipment is complete	TM 11-6625-267-12P
2	Exterior surfaces	Clean the exterior surfaces, including the panel and meter glasses (par. 34.3). Check all meter glasses and indicator lenses for cracks.	
3	Connectors	Check the tightness of all connectors.	
4	Controls and indicators	While making the operating checks (item 5), observe that the mechanical action of each knob, dial, and switch is smooth and free of external or internal binding, and that there is no excessive looseness. Also check the meters for sticking or bent pointers.	
5	Operation	Operate the equipment according to paragraph 44	Par. 44.

34. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Cables	Inspect cords, cables, and wires for chafed, cracked, or frayed insulation. Replace connectors that are broken, arced, stripped, or worn excessively.	
2	Handles and latches	Inspect handles, latches, and hinges for looseness. Replace or tighten as necessary.	
3	Metal surfaces	Inspect exposed metal surfaces for rust and corrosion. Clean and touch up paint as required (par. 34.4).	Par. 34.4.

34.1. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Lubrication	Lubricate the equipment (pars. 35–38, and fig. 15).	
2	Pluckout items	Inspect seating of pluckout items. Make certain that tube clamps grip tube bases tightly. See figure 5 for tube locations.	Fig. 5.
3	Transformer terminals	Inspect the terminals on the power transformer. All connections should be soldered. There should be no evidence of dirt or corrosion.	
4	Terminal boards	Inspect terminal boards for loose connections and cracked or broken insulation. See figures 40 and 40.1 for terminal board locations.	Figs. 40 and 40.1.
5	Resistors and capacitors	Inspect the resistors and capacitors for cracks, blistering, or other detrimental defects. See figures 13, 14, 33, 33.1, 35, 35.1, 36, 37, 37.1, 40, and 40.1 for capacitor and resistor locations.	
6	Gaskets and insulators	Inspect gaskets, insulators, bushings, and sleeves for cracks, chipping, and excessive wear.	
7	Variable capacitors	Inspect variable capacitors, C21, C24 and C25 for dirt, moisture, loose mountings, and misalinement of plates. Refer to figures 34 and 35 for location.	
8	Interior	Clean interior of chassis and cabinet.	

34.2. Quarterly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Publications	See that all publications are complete, serviceable, and current.	DA Pam 310–4.
2	Modifications	Check DA Pam 310–4 to determine if new applicable MWO's have been published. All URGENT MWO's must be applied immediately. All normal MWO's must be scheduled.	TM 38–750 and DA Pam 310–4.
3	Spare parts	Check all spare parts (operator and organizational) for general condition and method of storage. There should be no evidence of overstock, and all shortages must be on valid requisitions.	TM 11–6625–267–12P.

34.3. Cleaning

Inspect the exterior of the equipment. The exterior surfaces should be clean, and free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a clean soft cloth.

Warning: **Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. *Do not* use near a flame.**

b. Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with cleaning compound (FSN 7930–395–9542). After cleaning, wipe dry with a cloth.

c. Remove dust or dirt from plugs and jacks with a brush.

Caution: **Do not press on the meter face (glass) when cleaning; the meter may become damaged.**

d. Clean the front panels, meters, and control knobs; use a soft clean cloth. If necessary, dampen the cloth with water; mild soap may be used for more effective cleaning. Wipe dry with a cloth.

34.4. Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 9–213.

Page 34. Delete section III.

Page 86. Add section V (as added by C 4, 30 Jan 63) after section IV.

Section V. DEPOT INSPECTION STANDARDS

102.1. Applicability of Depot Inspection Standards

The tests outlined in this section are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests.

102.2. Applicable References

a. Repair Standards. Applicable paragraphs of signal corps repair standards in TB SIG 355–1, TB SIG 355–2, and TB SIG 355–3 form a part of this standard.

b. Modification Work Orders. Perform all modification work orders applicable to this equipment before making the tests specified. DA Pam 310–4 lists all available MWO's.

102.3. Test Facilities Required

The following equipment is required for depot inspection:

Item	Technical manual	Common name
Audio Oscillator TS–382A/U	TM 11–2684A	Audio oscillator
Converter, Frequency Electronic CV–394/USA–5		Converter
Frequency Meter AN/USM–26	TM 11–5057	Frequency meter
Indicator, Panoramic IP–173A/U	TM 11–5086	Panoramic indicator
Meter, Modulation ME–57/U	TM 11–6625–400–12	Modulation meter
Multimeter ME–26B/U	TM 11–6625–200–12	Multimeter
Signal Generator AN/USM–44	TM 11–6625–508–10	Signal generator
Spectrum Analyzer TS–723/U	TM 11–5097	Analyzer
Test Set, Radio Frequency Power AN/USM–96A	TM 11–6625–248–12	Test set
Electronic Voltmeter ME–30A/U	TM 11–6625–320–12	Voltmeter
Receiver, Radio R–390/URR	TM 11–5820–357–10	Receiver
Receiver, Radio R–220/URR	TM 11–882	R–220/URR
Wattmeter AN/URM–98	TM 11–5124	Wattmeter
Frequency Meter FR–67/U	TM 11–2698	Counter

102.4. General Test Conditions

All tests shall be conducted under the following conditions:

a. Make test at normal room temperature.

b. Allow the test equipment to warm up for at least 1½ hours.

102.5. RF Oscillator Frequency Tests

Connect the frequency meter to the SG–12 A/U. The frequency of the RF oscillator should be measured indirectly with the crystal calibrator and also directly at the calibration points given in the chart below. The accuracy shall be within the stated limits.

Frequency range	Settings (mc)	Accuracy (kc)	
		Direct	Indirect
Band A	20	100	6.0
	24	120	7.2
	28	140	8.4
Band B	27	135	8.1
	33	165	9.9
	39	195	11.7
Band C	38	190	11.4
	47	235	14.1
	56	280	16.8
Band D	46	230	13.8
	58	290	17.4
	70	350	21.0
Band E	66	330	22.0
	84	420	25.2
	102	510	30.6

102.6. Crystal Calibrator Frequency Test

Check the 2–mc crystal calibration oscillator against the frequency meter. The frequency of the crystal calibration oscillator should be 2mc ± 100 cps.

102.7. Internal Modulation Frequency Test

Connect the counter to the audio output of the ME–57/U set-up to measure the frequency deviation of the SG–12A/U. The internal modulation frequency should be 1,000 cps ± 50.

102.8. Frequency Deviation Tests

The indication on the frequency deviation meter with an internal or external signal shall be within the limits shown in the following chart:

RF band (mc)	Deviation range (kc)	Accuracy (kc)	
		Internal	External
19.7–55.3	50	± 8	±10
46.6–102.4	100	±15	±20

102.9. RF Output Tests

a. Connect the test equipment as shown in figure 45.1

Caution: **Be sure that the BIAS CURRENT switch on the AN/URM–98 is in the OFF position before connecting MX–2144/U to AN/URM–98.**

b. Set the controls on the AN/URM–98 as follows:

(1) COEF, switch to NEG.

(2) RES, switch to 200.

(3) POWER RANGE to +10 DEM.

(4) BIAS CURRENT switch and ZERO SET controls to obtain a 0-mw indication.

c. Set the controls of the SG–12A/U as follows:

(1) RF ATTENUATOR MICROVOLTS to 10K.

(2) OPERATION to MOD OFF.

d. Tune the SG–12A/U through its frequency range (19.7 mc to 102.4 mc).

e. Wattmeter AN/URM–98 shall indicate between 0.0375 and 0.0625 milliwatt.

102.10. IF Oscillator Frequency Tests

The frequency of the IF oscillator at each range shall be accurate to within the limits listed below:

Range (mc)	Accuracy (cps)
1.37	±137
1.40	±140
1.43	±143
4.27	±427
4.30	±430
4.33	±433
4.45	±445
5.00	±500
5.35	±535
15.00	±1500

102.11. IF Voltage Output Tests

The IF output voltage measured at the terminal alligator clips shall be 1 volt ±0.25 at 1.37, 4.25, 5.00, and 15.00 megacycles and variable from 10 microvolts to 1 volt ±25 percent at 1.37 mc.

102.12. IF Leakage Test

a. On the SG–12A/U, set the controls as follows:

(1) IF MICROVOLTS to OFF.

(2) IF level meter to 1.0.

b. Connect the IF output cable to Receiver, Radio R–390/URR and note the S-meter indication where the SG–12A/U is set to an IF frequency of 1.37 and 15.0 megacycles.

c. Inject signals of 1.37 and 15.0 megacycles from Signal Generator AN/USM–44 into Receiver, Radio R–390/URR, the amplitudes of which will give the same indication on the S-meter as noted in *b* above. Note the attenuator setting on the AN/USM–44.

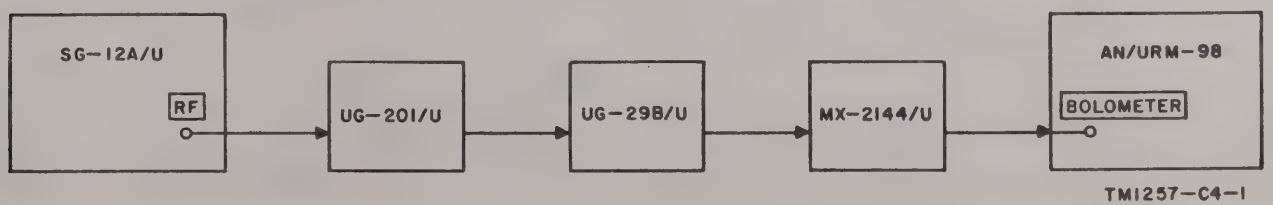

Figure 45.1. RF output test connections.

d. The output voltage at the termination of the IF cable shall not exceed 1 microvolt.

102.13. Radiation Tests

The radiation from the case of the SG–12A /U shall be measured by, and shall conform to, the limits specified in the following test procedure:

a. Construct a pickup coil with 2 turns of #10 AWG wire, 3 inches in diameter.

b. Connect the pickup coil to the antenna terminals of Receiver, Radio R–220/URR and connect the last IF stage to an RF voltmeter.

c. The generator under test is explored with the pickup coil at a distance of 5 inches from its case. When the point of maximum pickup is located, the RF voltmeter reading is noted with the R–220/URR properly tuned. After proper tuning, do not make any other receiver adjustments.

d. Signal Generator SG–12A/U is then removed from its present location and replaced by a radiating coil constructed with 2 turns of #10 AWG wire, 3 inches in diameter.

e. Connect the radiating coil to the RF cable termination (43) of the same signal generator. Coaxially align the radiating and pickup coils with the radiating coil, 5 inches from the center plane of the pickup coil.

f. The SG–12A/U output is increased until the same RF voltmeter reading noted in *c* above is obtained. Record the SG–12A/U output.

g. The voltage applied to the radiating coil to reproduce the pickup shall not exceed the values listed in the chart below.

Radio frequencies		
Band		Drive (microvolts)
A		17
B		35
C		35
D		85
E		170

102.14. Resetability Tests

The test shall be made at one frequency setting on each band. Approach the dial setting in a clockwise direction; be careful not to overshoot. Measure the frequency with Frequency Meter AN/USM–26. Continue to turn the vernier dial about half a revolution in the same clockwise direction and back to the first setting in a counterclockwise direction. Be careful not to overshoot. Measure the frequency as before. The difference between these two measured frequencies shall not be more than the resetability limits listed below:

Frequency (mc)	Resetability limits (kc)
24	4.8
33	6.6
47	9.4
58	11.6
84	16.8

102.15. Modulation Distortion Test

a. Connect the test equipment as shown in figure 45.2

b. Set the controls on the SG–12A/U as follows:

(1) BAND SWITCH to E.
(2) RF TUNING to 88 mc.
(3) OPERATION to 1000~.
(4) DEVIATION RANGE to 100.
(5) DEVIATION LEVEL control to a setting of 100 on the KILOCYCLES DEVIATION meter.

c. The distortion measured on Spectrum Analyzer TS–723/U shall be less than 5 percent.

102.16. RF Tuning Dial Clutch Test

The RF TUNING dial clutch shall permit shaft slippage when the dial is turned against a stop.

Page 91 (page 10 of C 2). Add the following:

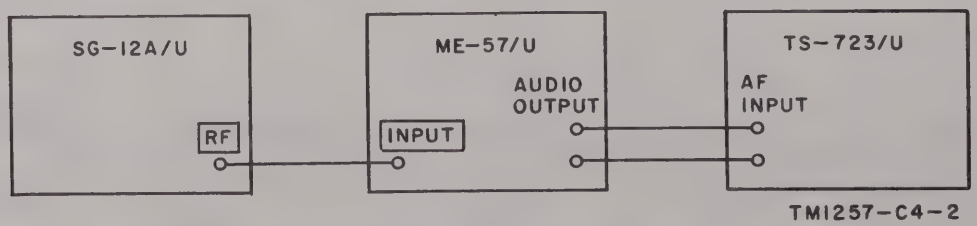

Figure 45.2. Modulation distortion test connections.

APPENDIX
REFERENCES

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders and Modification Work Orders.
TB SIG 355–1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355–2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355–3	Depot Inspection Standard for Moisture- and Fungus-Resistant Treatment.
TM 11–2684 and TM 11–6625–270–12	Audio Oscillators TS–312/FSM–1, TS–312A/FSM–1, and TS–382/U, and Signal Generator TS–312B/FSM–1.
TM 11–2698	Frequency Meter FR –67/U.
TM 11–5057	Frequency Meter AN /USM–26.
TM 11–5086	Panoramic Indicators IP–173/U, IP–173 A/U, IP–173B/U, and IP–173C/U.
TM 11–5097	Spectrum Analyzers TS–723A/U, TS–723B/U, and TS–723C/U.
TM 11–6625–200–12	Operator and Organizational Maintenance Manual Multimeters ME–26A/U and ME–26B/U.
TM 11–6625–248–12	Operation and Organizational Maintenance Radio Frequency Power Test Set AN/USM–96.
TM 11–6625–267–12P	Operator's and Organizational Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart, for Generator, Signal AN/URM–48.
TM 11–6625–267–35P	Field and Depot Maintenance Repair Parts and Special Tools List, Generator, Signal AN/URM–48.
TM 11–6625–320–12	Operator's and Organizational Maintenance Manual Voltmeter, Meter ME–30A/U, and Voltmeters, Electronic ME–30B/U and ME–30C/U.
TM 11–6625–400–12	Operator and Organizational Maintenance Manual Meter, Modulation ME –57/U.
TM 38–750	The Army Equipment Record System and Procedures.

By Order of the Secretary of the Army:

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Chief of Staff.

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5–48	11–587
5–600	11–592
5–605	11–597
7	11–608
7–52	17
7–100	17–100
9–217	29–1
11–5	29–15
11–6	29–16
11–7	29–21
11–8	29–25
11–16	29–26
11–35	29–35
11–36	29–36
11–38	29–51
11–55	29–55
11–56	29–56
11–57	29–65
11–85	29–75
11–86	29–76
11–87	29–79
11–97	29–105
11–98	29–109
11–116	32–56
11–117	32–57
11–155	37
11–157	37–100
11–500 (AA–AE) (4)	57
11–557	57–100

NG: State AG (3); units—same as active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

U.S. GOVERNMENT PRINTING OFFICE 1968-342-012-1475

TM 11–1257
* C 7

SIGNAL GENERATOR AN/URM–48

CHANGE
No. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D. C., *26 October 1964*

TM 11–1257, 8 December 1953, is changed as follows:

Note. The parenthetical reference to previous changes (example: "page 1 of C 5") indicates that pertinent material was published in that change.

Page 7, pargraph 2*c* (page 1 of C 5). Line 10. Delete the fourth sentence and substitute: The original and one copy will be forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL–MR–MP–P, Fort Monmouth, N. J. 07703.

Page 82, paragraph 90.9*c* (foldout opposite page 14 of C 3) (As changed by C 6, 17 Mar 64). Make the following changes in the "Performance standard" column:

Step No. 1, item *e*. Delete 950–1,050 and substitute 920–1080.

Step No. 2, item *c*. Delete 5% and substitute 10%.

Paragraph 90.13*d* (As changed by C 6, 17 Mar 1964). Make the following changes:

Subparagraph (1). Delete 5% and substitute: 10%.

Subparagraph (2). Delete ±5% and substitute: ±8%.

Page 85, paragraph 99*b*(5) (As changed by C 6, 17 Mar 64). Delete 5 percent and substitute: 10 percent.

Page 86. Make the following changes:

Paragraph 102.3 (page 4 of C 5). Chart, line 5. Delete the information for the ME–57/U and substitute:

Item	Technical manual	Common name
Signal Generator AN/URM–25F	TM 11–5551E	Signal generator

Paragraph 102.7 (As changed by C 6, 17 Mar 64). Delete ±50 and substitute ±80.

Paragraph 102.12*c* (page 5 of C 5). Lines 2 and 6. Change AN/USM–44 to AN/URM–25F.

Paragraph 102.15*c* (As changed by C 6, 17 Mar 64). Delete 5 percent and substitute: 10 percent.

Page 91 (page 6 of C5). Make the following changes:

Designate the existing appendix: I.

Add the following reference.

TM 11–5551E ..... RF Signal Generator AN/URM–25F

*** This change supersedes C 6, 17 March 1964, and so much of TM 11–6625–267–12P, 15 April 1959, including C 2, 14 August 1961, as pertains to the first echelon functional parts list and maintenance allocation chart.**

Add appendixes II and III after appendix I.

APPENDIX II

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

1. General

a. This section assigns maintenance functions to be performed on components, assemblies, and subassemblies by the lowest appropriate maintenance category.

b. Columns are as follows:

(1) *Part or component.* This column shows only the nomenclature or standard item name. Additional descriptive data are included only where clarification is necessary to identify the component. Components, assemblies, and subassemblies are listed in top-down order. That is, the assemblies which are part of a component are listed immediately below that component, and the subassemblies which are part of an assembly are listed immediately below that assembly. Each generation breakdown (components, assemblies, or subassemblies) is listed in disassembly order or alphabetical order.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelons:

(*a*) *Service.* To clean, to preserve, and to replenish lubricants.

(*b*) *Adjust.* To regulate periodically to prevent malfunction.

(*c*) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(*d*) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(e) *Replace.* To substitute serviceable components, assemblies, or subassemblies, for unserviceable components, assemblies, or subassemblies.

(*f*) *Repair.* To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

(*g*) *Align.* To adjust two or more components of an electrical system so that their functions are properly synchronized.

(*h*) *Calibrate.* To determine, check, or rectify the graduation of an instrument, weapon, or weapons system or components of a weapons system.

(*i*) *Overhaul.* To restore an item to *completely serviceable* condition as prescribed by serviceability standards. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

(*j*) *Rebuild.* To restore an item to a standard as near as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of completed disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and/or specifications, and subsequent reassembly of the item.

(3) *1st, 2d, 3d, 4th, and 5th echelon* (*operator, direct and general support, and depot maintenance*). The symbol X indicates the category responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the category marked by X are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding columns.

c. Columns in the allocation of tools for maintenance functions are as follows:

(1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *1st, 2d, 3d, 4th, and 5th echelon* (*operator, direct and general support, and depot maintenance*). The dagger (†) indicates the category normally allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

2. Maintenance by Using Organizations

When this equipment is used by Signal services organizations organic to theater headquarters or communication zones to provide theater communications, those maintenance functions allocated up to and including general support are authorized to the organization operating this equipment.

Section II. MAINTENANCE ALLOCATION CHART

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
GENERATOR, SIGNAL AN/URM-48	repair				X			
	rebuild					X	13	
	service	X						
	adjust				X	X	7,9	
	inspect	X						
	test				X	X	1,3,4,5,6,8,10 11,12	
	align				X	X	1,2,4,5,6,8,12	
	calibrate				X	X	4,5,6,12	
CASE, SIGNAL GENERATOR CY-1217/U	replace					X		Fabricate
	repair				X			
CATCH, FASTENER	replace				X			
DUMMYLOAD, ELECTRICAL DA-69/URM-48	replace		X					
GENERATOR, SIGNAL SG-12/U, SG-12A/U	rebuild					X		
	repair				X			
ATTENUATORS	replace				X			
CABLE ASSEMBLY, POWER, ELECTRICAL	repair		X					
CABLE	replace			X				
CONNECTOR	replace		X					
CABLE ASSEMBLIES, RADIO FREQUENCY	repair			X				
CABLE, RADIO FREQUENCY	replace			X				
CONNECTORS	replace			X				
CAPACITORS	replace				X			
CHAIN, WELDED	replace				X			
CHOKE, RADIO FREQUENCY	replace				X			
CLAMP, ELECTRICAL	replace				X			
CLIPS, ELECTRICAL	replace			X				
COILS, RADIO FREQUENCY	replace				X			
CONNECTORS	replace			X				
CONTACTS, ELECTRICAL	replace				X			
COUPLINGS, FLEXIBLE	replace				X			
CRYSTAL UNITS CR-19/U	replace				X			
SEMI-CONDUCTOR DEVICES DIODE	replace				X			
CURSOR, INDICATOR	replace				X			
CURSOR, INDICATOR			X					RF tuning and RF attenuator
DIALS	replace				X			
DRIVE, TUNING	replace				X			
ELECTRON TUBES (V1, V2, V3, V9 thru V13)	replace	X						
ELECTRON TUBES (V4 thru V8)	replace				X			
FILTERS, LOW PASS	replace				X			

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/URM-48 (continued)								
FUSES, CARTRIDGE	replace	X						
FUSEHOLDERS	replace			X				
CAPS, FUSEHOLDER	replace		X					
GASKET	replace		X					
GEARS	replace					X		Fabricate or obtain from salvage
INSERTS, ELECTRICAL CONNECTOR	replace				X			
INSULATORS	replace				X			
KNOBS	replace		X					
LAMPS	replace	X						
LIGHTS, INDICATOR	replace			X				
	repair		X					
LENSES, INDICATOR LIGHT	replace		X					
LOCK	replace			X				
LOUDSPEAKER, PERMANENT MAGNET	replace			X				
METER, MODULATION	replace			X				
NUTS (common hardware)	replace			X				Available in Maintenance Equipment ME-9 and Hardware Kit MK-41/U
POST, BINDING	replace			X				
REACTORS	replace				X			
RESISTORS	replace				X			
RETAINERS	replace				X			
SCREWS (common hardware)	replace			X				Available in Maintenance Equipment ME-9 and Hardware Kit MK-41/U
SHIELDS, ELECTRON TUBE	replace		X					
SOCKET, CRYSTAL	replace				X			
SOCKETS, ELECTRON TUBE	replace				X			
SPRINGS	replace				X			
SPROCKETS	replace					X		Fabricate or obtain from salvage
STUDS, THREADED	replace				X			
SUPPRESSORS, PARASITIC	replace				X			
SWITCH, PUSH	replace			X				
SWITCHES, ROTARY	replace				X			
SWITCHES, TOGGLE	replace			X				
TRANSFORMERS	replace				X			
VOLTMETER	replace			X				
WASHERS (common hardware)	replace			X				Available in Maintenance Equipment ME-9 and Hardware Kit MK-41/U

Section III. ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH.	(3) 2ND ECH.	(4) 3RD ECH.	(5) 4TH ECH.	(6) 5TH ECH	(7) TOOL CODE	(8) REMARKS
ANALYZER SPECTRUM TS-723/U				†	†	1	
AUDIO OSCILLATOR TS-382/U				†	†	2	
CRYSTAL RECTIFIER TEST SET TS-268/U				†	†	3	
FREQUENCY METER AN/URM-79				†	†	4	
FREQUENCY METER AN/URM-80				†	†	5	
METER, MODULATION ME-57/U				†	†	6	In developement, Indicator, Panoramic IP-173/U; Interim item, Signal Generator TS-497/URR
MULTIMETER AN/URM-105				†	†	7	In procurement, interim item Multimeter TS-352/U
MULTIMETER, METER ME-26/U				†	†	8	
SHUNT, INSTRUMENT, MULTIRANGE MX-1471/U				†	†	9	In procurement, interim Multimeter TS-352/U
TEST SET, ELECTRON TUBE TV-2/U					†	10	
TEST SET, ELECTRON TUBE TV-7/U				†		11	
VOLTMETER, METER ME-30/U				†	†	12	
TOOL EQUIPMENT TK-21/G				†	†	13	

APPENDIX III

BASIC ISSUE ITEMS LIST

Section I INTRODUCTION

1. General

This appendix lists items supplied for initial operation and for running spares. The list includes tools, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipments are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

2. Columns

Columns are as follows:

a. Federal Stock Number. This column lists the 11-digit Federal stock number.

b. Designation by Model. Not used.

c. Description. Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

d. Unit of Issue. The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

e. Expendability. Nonexpendable items are indicated by NX. Expendable items are not annotated.

f. Quantity Authorized. Under "Items Comprising an Operable Equipment," the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spare Items" the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

g. Illustration. Not used. The "Item No." column lists the reference symbols used for identification of the item in the illustration or text of the manual.

Section II. FUNCTIONAL PARTS LIST

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO.	(9) ILLUSTRATIONS ITEM NO.
		1 2	ITEMS COMPRISING AN OPERABLE EQUIPMENT					
			GENERATOR, SIGNAL AN/URM-48					
	6625-545-7954		GENERATOR, SIGNAL AN/URM-48	ea	NX			
	Order thru AGC		TECHNICAL MANUAL TM 11-6625-267-12P	ea	X	2		
	Order thru AGC		TECHNICAL MANUAL TM 11-1257	ea	X	2		
	6625-260-1447		CASE, SIGNAL GENERATOR CY-1217/U	ea	NX	1		
	5985-537-4439		Ø DUMMY, LOAD, ELECTRICAL DA-69/URM-48	ea	X	1		
	6625-669-0124		GENERATOR, SIGNAL SG-12/U; SG-12A/U	ea	NX	1		
			GENERATOR, SIGNAL SG-12/U; SG-12A/U					
			NOTE: Model Column 1 refers to SG-12/U; Model Column 2 refers to SG-12A/U					
	5920-583-5057	† †	CAP, ELECTRICAL: bakelite; 7/16 in lg x 21/32 in dia; Littlefuse part No. 342008	ea	X	1		
	5910-192-1985	† †	CAPACITOR, FIXED, ELECTROLYTIC: MIL type CE53C100Q	ea	X	1		C6A C6B C6C
	5910-284-4697	† †	Ø CAPACITOR, FIXED, ELECTROLYTIC: MIL type CE52C350Q	ea	X	1		C37A C37B
	5995-667-7631	†	Ø CRYSTAL UNIT CR-19/U; 1370 kc nom freq	ea	NX	1		
	5955-267-5089	†	Ø CRYSTAL UNIT CR-19/U; 1400 kc nom freq	ea	NX	1		Y1
		†				1		Y2
	5955-267-5092	†	Ø CRYSTAL UNIT CR-19/U; 2650 kc nom freq	ea	NX	1		Y3
	5955-667-7647	†	Ø CRYSTAL UNIT CR-19/U; 1430 kc nom freq	ea	NX	1		Y3
	5955-668-3553	†	Ø CRYSTAL UNIT CR-19/U; 4270 kc nom freq	ea	NX	1		Y4
	5955-267-5093	†	Ø CRYSTAL UNIT CR-19/U; 2880 kc nom freq	ea	NX	1		Y4
	5955-267-5090	† †	Ø CRYSTAL UNIT CR-19/U; 4300 kc nom freq	ea	NX	1		Y5
	5955-668-0357	†	Ø CRYSTAL UNIT CR-19/U; 4330 kc nom freq	ea	NX	1		Y6
	5955-132-6686	†	Ø CRYSTAL UNIT CR-19/U; 4450 kc nom freq	ea	NX	1		Y6
		†				1		Y7
	5955-267-5094	†	Ø CRYSTAL UNIT CR-19/U; 5000 kc nom freq	ea	NX	1		Y7
		†				1		Y8
	5955-267-5091	† †	Ø CRYSTAL UNIT CR-19/U; 5350 kc nom freq	ea	NX	1		
	5955-267-5083	† †	Ø CRYSTAL UNIT CR-19/U; 2000 kc nom freq	ea	NX	1		Y10

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL 1	2	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO	(9) ILLUSTRATIONS ITEM NO
		1	2	AN/URM-48 (continued)					
	5955-267-5084	†		Ø CRYSTAL UNIT CR-19/U: 2515 kc nom freq	ea	NX	1		Y2
	5955-132-6687	†	†	Ø CRYSTAL UNIT CR-19/U: 15,000 kc nom freq	ea	NX	1 1		Y9 Y11
	5960-262-0964	†	†	Ø ELECTRON TUBE: MIL type 0A2WA	ea	X	1		V11
	5960-262-0218	†	†	Ø ELECTRON TUBE: MIL type 5Y3WGTA	ea	X	1		V10
	5960-166-7667	†	†	Ø ELECTRON TUBE: MIL type 6AH6	ea	X	6		V1 V2 V4 V5 V7 V8
	5960-188-3551	†	†	Ø ELECTRON TUBE: MIL type 6AK6	ea	X	1		V14
	5960-235-8215	†	†	Ø ELECTRON TUBE: MIL type 6C4W	ea	X	3		V9 V12 V13
	5960-228-3764	†	†	Ø ELECTRON TUBE: MIL type 6J6W	ea	X	1		V6
	5960-166-7663	†	†	Ø ELECTRON TUBE: MIL type 12AU7	ea	X	1		
	5920-199-3969	†	†	Ø FUSE CARTRIDGE: Littelfuse part No. 313001	ea	X	2		F1 F2
	6625-521-1156	†		KIT, DUMMY ANTENNA: used to modify sig gen; ARF part No. 132B12775; (to be issued to equip not having dummy ant)	ea	X	1		
	6240-223-9100	†	†	Ø LAMP, GLOW: GE type No. NE51	ea	X	1		F6
	6240-155-7857	†	†	Ø LAMP, INCANDESCENT: GE type No. 328	ea	X	2		I1 I2
	6240-408-3394	†	†	Ø LAMP, INCANDESCENT: GE type 3S6DC	ea	X	1		I3
	6240-155-8706	†	†	Ø LAMP, LM-52	ea	X	1		
	6210-188-8778	†	†	LENS, INDICATOR LIGHT: colorless; Dialco part No. 95-937	ea	X	1		
	5905-299-1754	†	†	Ø RESISTOR, THERMAL: Amperite type No. 9-4	ea	X	1		RT1
	5960-223-4598	†	†	RETAINER, ELECTRON TUBE: 2-1/8 in lg x 1-1/2 in w x 11/16 in h; Times Facsimile No. 3T hat	ea	X	1		
	5960-273-2434	†	†	RETAINER, ELECTRON TUBE: 2 in lg x 1-15/32 in w x 23/32 in h; Times facsimile No. 2 hat	ea	X	3		
	5960-243-0693	†	†	SHIELD, ELECTRON TUBE: JAN type TS102U03	ea	X	1		E11
	5960-272-9094	†	†	SHIELD, ELECTRON TUBE: JAN type TS102U02 Item Nos: E1 E2 E4 thru E9 E12 E13 E14	ea	X	11		See Desc Column
	5960-264-3004	†	†	SHIELD, ELECTRON TUBE: JAN type TS-103U02	ea	X	1		E3

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO.	(9) ILLUSTRATIONS ITEM NO
		1 2	AN/URM-48 (continued)					
			RUNNING SPARES AND ACCESSORY ITEMS					
			GENERATOR, SIGNAL SG-12/U; SG-12A/U					
	5960-262-0964	† †	Ø ELECTRON TUBE: MIL type 0A2WA	ea	X	1		V11
	5960-262-0218	† †	Ø ELECTRON TUBE: MIL type 5Y3WGTA	ea	X	1		V10
	5960-166-7667	† †	Ø ELECTRON TUBE: MIL type 6AH6	ea	X	2		V1 V2 V4 V5 V7 V8
	5960-188-3551	† †	Ø ELECTRON TUBE: MIL type 6AK6	ea	X	1		V14
	5960-235-8215	† †	Ø ELECTRON TUBE: MIL type 6C4W	ea	X	1		V9 V12 V13
	5960-228-3764	† †	Ø ELECTRON TUBE: MIL type 6J6W	ea	X	1		V6
	5960-166-7663	† †	Ø ELECTRON TUBE: MIL type 12AU7	ea	X	1		
	5920-199-3969	† †	Ø FUSE CARTRIDGE: Littlefuse part No. 313001	ea	X	5		F1 F2
	6240-223-9100	† †	Ø LAMP GLOW: GE type No. NE51	ea	X	1		I6
	6240-155-7857	† †	Ø LAMP, INCANDESCENT: GE type No. 328	ea	X	1		I1 I2
	6240-408-3394	† †	Ø LAMP, INCANDESCENT: GE type 3S6DC	ea	X	1		I3
	6240-155-8706	† †	Ø LAMP, LM-52	ea	X	1		
	5905-299-1754	† †	Ø RESISTOR, THERMAL: Amperite type No. 9-4	ea	X	1		RT1
	5120-392-8375	† †	WRENCH, SOCKET HEAD SCREW: for No. 6 Allen set screw; ARF part No. 227B12678	ea	X	1		
			GENERATOR, SIGNAL AN/URM-48					
			NO PARTS AUTHORIZED FOR STOCKAGE AT FIRST ECHELON					

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12–31 requirements for Field Maintenance Instructions for OV–1 and OH–13 aircraft.

U. S. GOVERNMENT PRINTING OFFICE: 1964—754427/285

823–140

CHANGE
No. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, *D.C., 23 August 1966*

SIGNAL GENERATOR AN/URM-48

TM 11-1257, 8 December 1953, is changed as follows:

Note. The parenthetical reference to a previous change (example: "page 1 of C 7") indicates that pertinent material was published in that change.

Page 7, paragraph 2*c* (page 1 of C 7). Delete and substitute:

c. Reporting of Equipment Manual Improvement. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications), will be used for reporting these improvements. This form will be completed using pencil, pen, or typewriter and forwarded direct to Commanding General, U. S. Army Electronics Command, ATTN: AMSEL-MR-(NMP)-MA, Fort Monmouth, N. J., 07703.

Page 86, Make the following changes:

Paragraph 102.3 (page 1 of C 7).

Chart. Add the following:

Item	Technical manual
Radio Interference Measuring Set AN/URM-85.	TM 11-6625-351-12

Paragraph 102.13 (page 6 of C 5). Delete and substitute:

102.13. Radiation Tests

a. The radiation from the RF portion of the signal generator should not produce a signal more than 1.0 microvolt in a single loop 3.0 inches in diameter located 5 inches from the instrument under test. The plane of the pickup loop should be parallel with the points measured.

b. Make the radiation tests at the high end of each band as follows:

(1) Connect the signal generator under test to the signal input of the AN/URM-85 through the normal RF termination (10-ohm output).

(2) Adjust the frequency being checked for maximum output by adjustment of the AN/URM-85 *TUNING* control. Set the output of Signal Generator SG-12A/U to 1.0 microvolt and adjust the gain control on the AN/URM-85 for a convenient reference level on its indicating meter (above noise level).

(3) Leave the SG-12A/U attenuator set at 1.0 microvolt or less. Disconnect the SG-12/U from the AN/URM-85 (signal generator input) and connect the 3-inch pickup loop to the signal input cable. Scan the SG-12U with the pickup loop at a distance of 5 inches from the instrument. The maximum indication obtained should not exceed the reference level established on the AN/URM-85.

Page 91, appendix I (page 1 of C 7). Add the following to the references:

TM 11-6625-351-12 — Operator and Organizational Maintenance Manual: Radio Interference Measuring Set AN/URM-85.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM
Major General, United States Army,
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  9th LOGCOMD (10)
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37-100
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55-89
55-99
55-405
55-407
55-417
55-457
57
57-100

NG: State AG (3); units — same as active Army except allowance is one (1) copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320-50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1966—254427/987

TECHNICAL MANUAL
No. 11-1257
TECHNICAL ORDER
No. 16-30URM48-5

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *8 December, 1953*

SIGNAL GENERATOR AN/URM-48

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WARNING

HIGH VOLTAGE

is used in the operation of
this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

ARTIFICIAL RESPIRATION

GENERAL PRINCIPLES

1. Seconds count! Begin at once! Don't take time to move the victim unless you must. Don't loosen clothes, apply stimulants or try to warm the victim. Start resuscitation! Get air in the lungs! You may save a life!

2. Place the victim's body in a prone position, so that any fluids will drain from the respiratory passages. The head should be extended and turned sideward *never flexed forward;* the chin shouldn't sag, since obstruction of the respiratory passages may occur.

3. Remove any froth or debris from the mouth with your fingers. Draw the victim's tongue forward.

4. Begin artificial respiration. Continue it rhythmically and without any interruption until natural breathing starts or the victim is pronounced dead. Try to keep the rhythm smooth. Split-second timing is not absolutely essential.

5. When the victim starts breathing, or when additional help is available loosen the clothing; remove it, if it's wet; keep the victim warm. Shock should receive adequate attention. Don't interrupt the rhythmical artificial technique for these measures. Do them only when you have help or when natural breathing has started.

6. When the victim is breathing, adjust your timing to assist him. Don't fight his efforts to breathe. Synchronize your efforts with his. After resuscitation, keep him lying down until seen by a physician or until recovery seems certain.

7. Don't wait for mechanical resuscitation! If an approved model is available, use it, but, since mechanical resuscitators are only slightly more effective than properly performed "push-pull" manual technique, *never* delay manual resuscitation for it.

BACK-PRESSURE ARM LIFT METHOD

1. *Position of Victim.* Place the victim in the prone (face-down) position. Bend his elbows; place one hand upon the other. Turn his face to one side, placing his cheek upon his hands.

2. *Position of Operator.* Kneel on your left or right knee, at the victim's head, facing him. Your knee should be at the side of the victim's head close to his forearm, your foot should be near his elbow. Kneel on both knees if you find it more comfortable, with one knee on each side of the head. Place your hands on the flat of the victim's back so that their heels are just below the lower tip of his shoulder blades. With the tip of your thumbs touching spread your fingers downward and outward. (See A)

3. *Compression Phase.* Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert a slow, steady, even, downward pressure upon your hands. This forces air out of the lungs. Keep your elbows straight and press almost directly downward on the back. (See B)

4. *Expansion Phase.* Release the pressure, avoid any finish thrust, and commence to rock backward slowly. Place your arms upon the victim's arms just above the elbows, and draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders.

Don't bend your elbows. As you rock backward, the victim's arms will be drawn toward you. (The arm lift expands the chest by pulling on the chest muscles, arching the back and relieving the weight on the chest.) Drop the arms gently to the ground or floor. This completes the cycle. (See C and D). Now. repeat the cycle.

5. *Cycle Timing and Rhythm.* Repeat the cycle 10 to 12 times per minute. Use a steady uniform rate of Press, Release, Lift, Release. Longer counts of about equal length should be given to the "Press" and "Lift" steps of the compression and expansion phases. Make the "Release" periods of minimum duration.

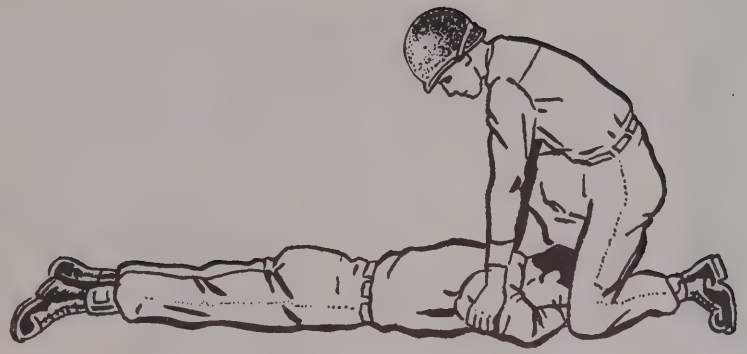
6. *Changing Position or Operator.*

(*a*) Remember that you can use either or both knees or can shift knees during the procedure, provided you don't break the rhythm. Observe how you rock forward with the back-pressure and backward with the arm-lift. The rocking motion helps to sustain the rhythm and adds to the ease of operation.

(*b*) If you tire and another person is available, you can "take turns." Be careful not to break the rhythm in changing. Move to one side and let your replacement come in from the other side. Your replacement begins the "Press-Release" after one of the "Lift-Release" phases, as you move away.

A Position of operator and victim

B Compression phase



C Expansion phase (arm lift)

D Expansion phase (arm release)

TM AR-4

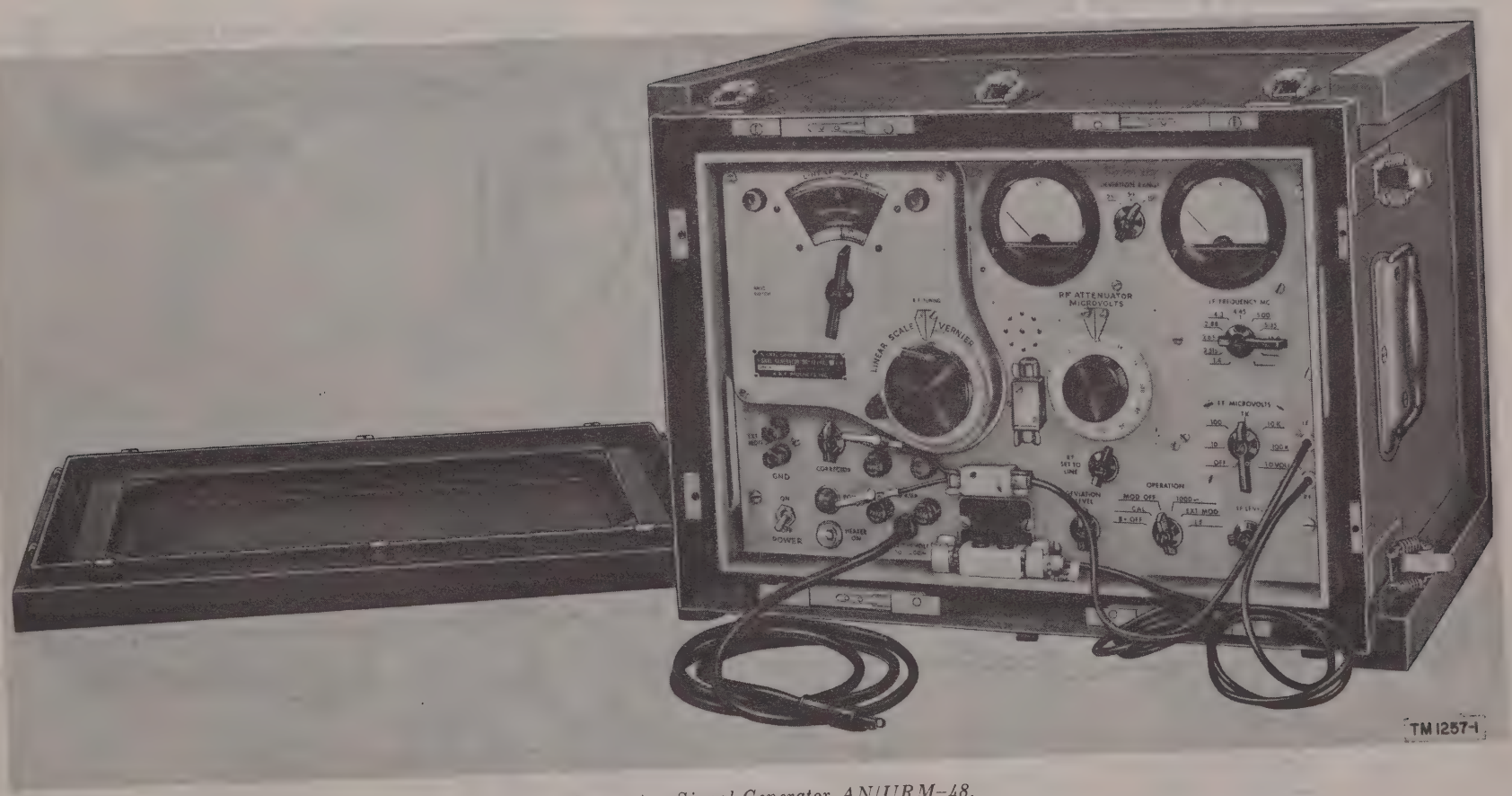


Figure 1. Signal Generator AN/URM–48.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

This technical manual contains the necessary information for the installation, operation, maintenance, and repair of Signal Generator AN/URM–48 (fig. 1).

a. Signal Generator AN/URM–48 consists of Signal Generator SG–12/U carried in Case CY–1217/U accompanied by Electrical Dummy Load DA–69/URM–48. Generally, throughout the manual the equipment will be referred to as Signal Generator SG–12/U or as the signal generator.

b. There are two appendixes covering a list of references and an identification table of parts, and an index.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 10).

e. DA Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 11).

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Signal Generator SG–12/U (fig. 2) is a precision test instrument designed to provide both f-m (frequency-modulated) and unmodulated r-f (radio-frequency) signals for various measurements and alinement. It contains 14 tubes (including a rectifier and voltage regulator). The unmodulated signals from the generator are used mainly for sensitivity and alinement purposes. The f-m signals are used as a means for checking band-pass characteristics of f-m receivers. With the proper auxiliary equipment, the f-m output also may be used for alinement. Signal Generator SG–12/U is designed primarily for use with components of the standardized series radio sets, such as Receiver–Transmitters RT–66/GRC, RT–67/GRC, RT–68/GRC, and RT–70/GRC.

a. The signal generator is a self-contained unit, which is housed in a heavy gage metal dust cover. In transit, the signal generator is installed within a special shock-mounted metal case (Case CY–1217/U), which protects the equipment from shock on all sides.

b. Signals are taken from the signal generator by means of two output cables (fig. 2). One of these cables supplies output voltage at nine different crystal-controlled frequencies (i-f (intermediate-frequency)). These frequencies coincide

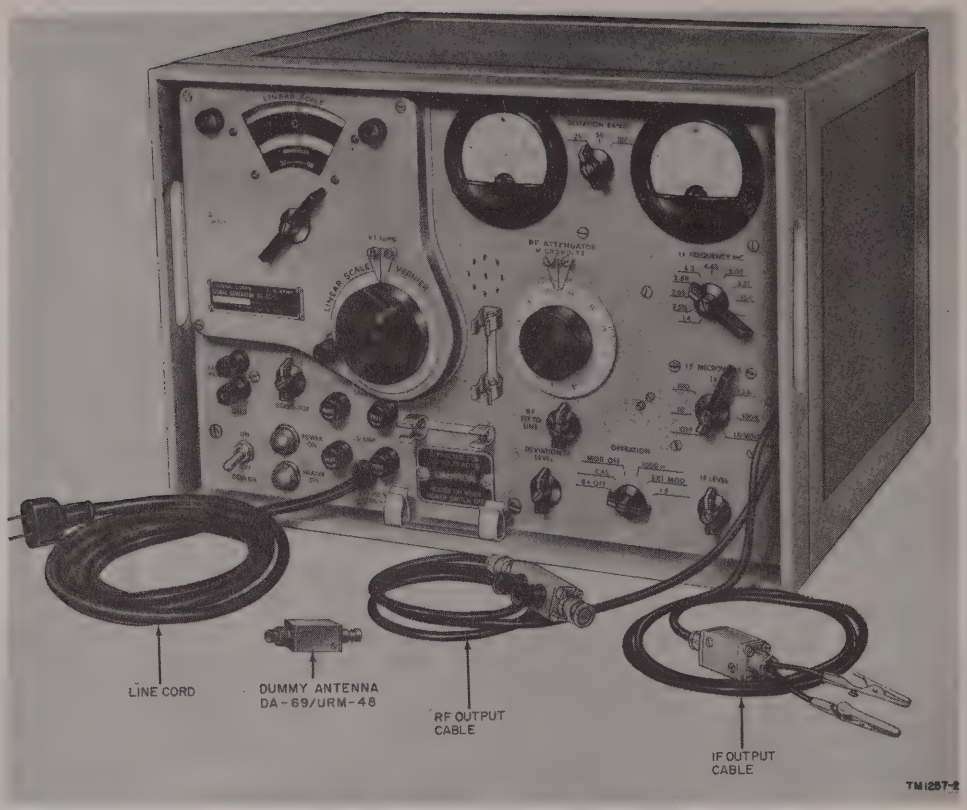


Figure 2. Signal Generator SG–12/U, showing output cables.

with the intermediate frequencies used by the various receivers to be tested. A second cable supplies r-f output signals in the frequency range of 20 to 100 mc (megacycles) in five bands. These h-f (high-frequency) ranges may be unmodulated, frequency-modulated internally at a rate of 1,000 cps (cycles per second) with variable deviation, or modulated at a rate of 100 to 20,000 cps, determined by an external a-f (audio-frequency) source with variable deviation.

c. The amplitudes of the i-f and r-f outputs can be adjusted individually, since there are two attenuators. The permanently connected coaxial cables, used for the transfer of the r-f and i-f signals, have terminating heads which present output inpedances of 10 ohms (at the r-f cable head) and 25 ohms (at the i-f cable head).

d. A built-in crystal calibrator provides marker calibration points every 1 mc in the 20- to 50-mc range, and every 2 mc in the 50- to 100-mc range. The i-f ranges do not require calibration, since each intermediate frequency is crystal-controlled.

e. The signal generator may be operated from a power source providing either 115 or 230 volts, in a frequency range of 50 to 1,000 cps.

4. Application

a. In general, the signal generator is to be used when an r-f or i-f signal is needed for servicing or testing f-m receivers (fig. 3). The signal generator r-f output is variable continuously from .05 to 10,000 μv (microvolts). The i-f output is variable from .5 μv to 1 volt. With this feature, the signal generator can be used for many purposes in that the signals may be injected at almost any signal point in the receiver and can be varied to suit the troubleshooting or testing demands. The frequency accuracy of the output signal is high enough to calibrate accurately the r–f tuning portions of receivers under test.

b. A few of the applications of the signal generator are listed below:

(1) Oscillator calibration.
(2) Sensitivity.
(3) Signal plus noise to noise ratio.
(4) A-m (amplitude-modulation) rejection.
(5) Overall distortion.
(6) Power sensitivity.
(7) Alinement (r-f and i-f).
(8) I-f and r-f band-pass characteristics.
(9) Discriminator characteristics.

crate the signal generator is protected from shock by the use of two separate cartons and adequate cardboard cells and other padding. The inner carton is protected from moisture by paper and metal foil sealed wrapping. Within the carton are bags of silica gel. The spare parts and tools are wrapped individually and then sealed in a moisture-vaporproof bag. The crate liner is waterproof and is sealed before the top cover is nailed to the crate. Heavy wire or metal banding is then tightened around the wooden crate to prevent the crate from bulging or splitting if subjected to rough treatment. Figure 4 shows the sequence of packaging. The size, weight, and volume of the crate are indicated in the following chart.

Note. Items may be packaged in a manner different from that shown, depending on the supply channel.

Number of crates	Height (in.)	Width (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
1	24¾	23	28⅞	9. 5	180

7. Table of Components of Signal Generator AN/URM–48

The following table lists the physical dimensions of the components for this equipment:

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Signal Generator SG–12/U	1	12	12	18	1. 5	72
Case CY–1217/U	1	16⅝	15⅝	21⅝	3. 2	34
Electrical Dummy Load DA–69/URM–48	1	¾	¾	3¼		
Technical Manual TM11–1257	2					
Total					4. 7	106

8. Description of Signal Generator SG–12/U

a. Signal Generator SG–12/U is housed in a gray metal dust cover. This dust cover must be removed for replacement of tubes, changing of crystals, and other types of maintenance or repair. The dust cover prevents the entrance of foreign materials (dirt, dust, and moisture) and also provides an insulating chamber, thereby minimizing condensation. All controls required for the operation of the signal generator are located on the front panel. One of the two front panel meters provides a check on the output signal level, the other indicates deviation when the output signal is frequency-modulated. A speaker mounted behind the front panel gives an aural indication of the calibration points when the crystal calibrator is in use.

b. The power line cord, line fuses, and operation voltage switch are mounted on the front panel for convenience. To adapt the signal generator to a power source of either 115 volts or 230 volts, remove the small cover plate at the bottom of the front panel and place the line-voltage switch in the proper position. The cover plate (CAUTION) is marked with one of the two voltages on each side and is to be turned to indicate the switch position. Clips are provided on the panel to secure the line cord, output cables, dummy antenna, and termination heads when the unit is in transit or storage.

c. All controls and instruments on the front panel are protected by the protruding edge of the front panel. This permits the signal generator to be turned front panel down when necessary for repair or adjustment. Slots are cut in the sides of this projection to provide grips for removing the generator from the dust cover. The mechanical construction of this instrument is unusually rigid to prevent mechanical distortion or warping, thereby assuring frequency stability despite stresses placed on the dust cover or chassis. Signal Generator SG–12/U is capable of laboratory precision and, because of its rugged construction, it can withstand the rough requirements demanded by service in field operations.

d. The r-f dial scales (20 to 100 mc) are illuminated by instrument lights, which throw their light between the dial and dial window. This eliminates objectionable shadows caused by external light passing the dial hairline. Each of the five r-f bands has a separate dial scale. A dial mask coupled to the BAND SWITCH allows only one dial scale to be seen at a time. This arrangement eliminates confusion of dial scales. The RF TUNING control knob can be prevented from

(10) Stage gain measurements.
(11) Image rejection ratio.

5. Technical Characteristics

Frequency range:	
R-f:	
Band A	19.5 mc to 29 mc.
Band B	26.5 mc to 39.5 mc.
Band C	37 mc to 56 mc.
Band D	46 mc to 70 mc.
Band E	66 mc to 102 mc.
I-f	1.4 mc.
	2.515 mc.
	2.65 mc.
	2.88 mc.
	4.3 mc.
	4.45 mc.
	5.0 mc.
	5.35 mc.
	15.0 mc.
	Two spare positions for future use.
Types of output:	
R-f	Unmodulated.
	Frequency-modulated:
	3 deviation ranges
	0 to 25 kc (kilocycles).
	0 to 50 kc.
	0 to 100 kc.
I-f	Unmodulated.
Accuracy:	
R-f (direct reading)	0.5%.
R-f (indirect reading)	Better than .03%.
Deviation	±1.0 db (decibel) (±12.5%).
Type of calibration	1-mc and/or 2-mc crystal markers.
Frequency of internal modulation.	1,000 cps ±5%.
A-f range for external modulation.	100 to 20,000 cps.
Output voltage (controlled by calibrated attenuator).	R-f output: .05 μv to .01 volt.
	I-f output: .5 μv to 1.0 volt.
Output voltage accuracy	±2 db.
R-f output impedance	10 ohms ±10%.
I-f output impedance	25 ohms.
Number of tubes	12, plus a rectifier and a voltage regulator.
A-c (alternating-current) line voltage input.	115 or 230 volts, 50 to 1,000 cps.
Power input	Approx 75 watts.
Weight	72 lbs (in dust cover only).
	106 lbs (in transit case).

6. Packaging Data
(fig. 4)

When packaged for export shipment, Signal Generator AN/URM–48 and its spare parts are packed in a wooden crate. Within the wooden

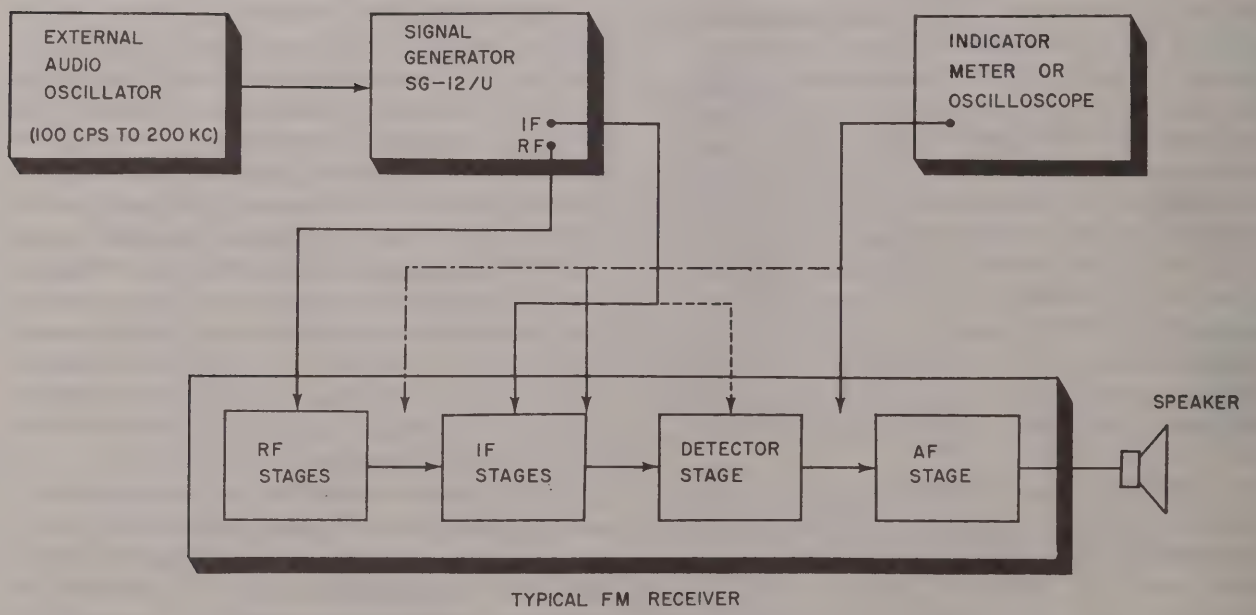


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Figure 3. Signal Generator SG–12/U applied to an f-m receiver.

shifting after the desired frequency is tuned, by tightening a screw-type friction dial lock. The RF TUNING control knob is the only r-f tuning control. The LINEAR SCALE at the outer edge (top mask window) of the dial is used in conjunction with the LINEAR SCALE VERNIER dial to interpolate between crystal marker frequencies. The numbers of the LINEAR SCALE are marked in red to distinguish it from the other scales. A folding handle on the RF TUNING knob speeds movement from one end of the scale to the other. Both the BAND SWITCH and the IF FREQUENCY MC controls are positive-acting because of the use of heavy spring detents. The heavy detent action assures positive electrical contact. The knobs used for the controls are of the bar type with the exception of the RF TUNING and RF ATTENUATOR MICROVOLTS controls.

e. The tubes used are of the miniature glass type, except for the h-v (high-voltage) rectifier. Incorporation of JAN parts and tubes makes replacements readily available from the Signal Corps standard stock parts. The signal generator is constructed in four basic subassemblies: front panel assembly, main chassis assembly, r-f oscillator subassembly, and i-f chassis subassembly. Resistor-type heaters are installed under the generator chassis to raise the ambient temperature inside the dust cover. These heaters operate when the line POWER switch is OFF, when of course, the line cord is plugged in. The heat reduces the possibility of condensation of water vapor when the equipment is not being used.

9. Description of Output Cable Heads and Electrical Dummy Load DA–69/URM–48

a. Each of the two output cables is terminated in L-pad networks, hereafter referred to as output termination heads. The r-f cable has a male coaxial connector which can be used to connect directly into a mating antenna connector on the receiver to be tested. Binding post connectors also are provided if some other means of connection is necessary. The r-f output terminal impedance is 10 ohms. The i-f head is terminated in a 50-ohm resistor and the voltage is taken off by short leads with insulated alligator spring clips. The i-f output termination head is fastened permanently to the i-f output cable. The output impedance is 25 ohms, 50 ohms in the termination head in parallel with 50 ohms in the attenuator.

b. Electrical Dummy Load DA–69/URM–48 consists of a 68-ohm resistor mounted within a metal case (¾ inch, by ¾ inch, by 3¾ inches). The case provides shielding. The dummy load, or dummy antenna, is inserted in the r-f line between the signal generator and the receiver under test, to simulate a whip antenna having a nominal impedance of 70 ohms. Connectors are provided for connecting the load to the r-f cable and for mating antenna connectors on receivers.

10. Running Spares

A group of running spares is supplied with Signal Generator AN/URM–48. Spares are provided for normally expendable items, such as tubes, pilot lamps, and fuses. The following is a list of running spares:

1 tube, type OA2.
1 tube, type 5Y3GT.
3 tubes, type 6AH6.
1 tube, type 6AQ5.
1 tube, type 6C4.
1 tube, type 6J6.
1 tube, type 12AU7.
1 resistor, thermal; Amperite 9–1.
12 fuses, 1-ampere slow blow.
1 lamp, 120-volt, 3-watt.
1 lamp, neon.
1 lamp, 6-volt, .2-ampere.
1 lamp, 6-volt.

11. Additional Equipment Required

In most tests made with Signal Generator SG–12/U, additional test equipment will be necessary to indicate gain, and to correct alinement or bandwidth of circuits. Each application will differ (at least slightly), therefore, it will be a matter of choosing the equipment best suited for the job. In general, the following test equipment may be used for the listed operations:

Type of test	Additional equipment
Alinement (c-w (continuous-wave) signal).	Sensitive r-f vtvm (vacuum-tube voltmeter), d-c (direct-current) vtvm, or microammeter.
Alinement (f-m signal)	Oscilloscope with suitable timebase and screen persistance. Audio oscillator.
Stage gain (c-w signal)	Sensitive r-f vtvm.
Overall gain	A-f meter or d-c vtvm.

Type of test	Additional equipment
Bandwidth (f-m signal)	Oscilloscope with suitable timebase and screen persistence. Audio oscillator.
Bandwidth (c-w signal)	Sensitive a-c or d-c vtvm.
Image rejection ratio	D-c vtvm.
Signal-plus-noise to noise ratio.	D-c vtvm.

12. Differences in Models

a. The first few signal generators which were manufactured on Order No. 14210–Phila–51–93 did not have regulated filament voltages for the r-f oscillator (V6) or modulator (V5) tubes. In these equipments, the circuits were wired differently in the power supply sections. These differences consisted of shorting out regulator tube RT1 and using a different power transformer

b. After serial number 20, the cathode resistors (R12 and R16) of calibration oscillator tube V3 were changed from a value of 270 ohms to a value of 820 ohms. Resistor R63 (820 ohms) was added in series with resistor R16. These changes assured calibration oscillator operation within the specified limitations of the tube.

c. After serial number 110, several changes were made to minimize the inherent noise (hum) of the signal generator. The filament circuits were isolated from ground in all tubes and both sides of the filament connections were balanced to ground in tubes V5, V6, V12, V13, and V14. The following components were added: L36, Z15, Z16, C67A, C67B, R107, and R108. Capacitor C64 was deleted from the circuit. Potentiometer R107 and resistor R108 form a hum balancing network which cancels the hum leakage between the filament and cathode of modulator tube V5.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

13. Siting

The location of the signal generator will depend on whether it is to be used in a laboratory-type set-up or in the field where a bench may not be available. The power source should be within 6 feet of the signal generator, and if this is not possible, an extension cord must be used. All operations and connections are made on the front panel; therefore, the signal generator may be placed directly against a wall, partition, or another piece of equipment, if necessary. Possibly, the most convenient arrangement is to place the generator on a shelf directly above and behind the unit being worked on. This arrangement keeps space available for tools and movement of the tested unit and also allows easy access to the controls of the signal generator. The shelf should be sufficiently close to the bench for the i-f and r-f cables to reach to the f-m receiver or other equipment being tested. An alternate arrangement is to place the signal generator on the bench alongside the receiver under test. In either case, the support used for the signal generator must be free from vibration, which could cause microphonics and noise during the testing procedure. If convenient, use the generator where there is little external electrical interference.

14. Uncrating, Unpacking, and Checking New Equipment

Caution: The signal generator is a precise laboratory instrument; rough handling during the unpacking process may render the unit worthless. If possible, unpack the signal generator in a location free from dust, dirt, and moisture.

a Unpacking (fig. 4).

(1) Cut the metal bands or wires which encircle the wooden crate; use a pair of tin snips or a large pair of diagonal cutting pliers.

(2) Use a nail puller, if one is available, to remove nails from the top cover. Pry open the top cover; be careful not to force the prying instrument too far into the package. Remove the top cover and save it for possible repacking. Save all the packing material except the silica gel for the same reason.

(3) Slit open the waterproof bag that contains the outer carton. Try not to damage the waterproof bag if it is to be reused, since the slit must be resealed.

(4) Take out the package containing the two instruction books.

(5) Open the flaps on top of the outer carton. Remove the cardboard cells and the spare parts box.

(6) Open the moisture-vaporproof bag by slitting it along the edge of its seal.

(7) Tip the crate over so that the top opening will be on the side and remove the inner carton by sliding it outward. Turn this carton with the flaps upward and open the flaps.

(8) Remove the padding from the cover of the transit case, and remove the four cardboard cells around its sides.

(9) Lift the transit case and generator out of the carton.

(10) The unpacking procedure now is complete, and the signal generator is ready for installation.

b. Checking. Always check equipment for possible shipping damage, such as a bent case, loose knobs, broken meter faces, bent shafts, and damaged cables. The contents of the crate should

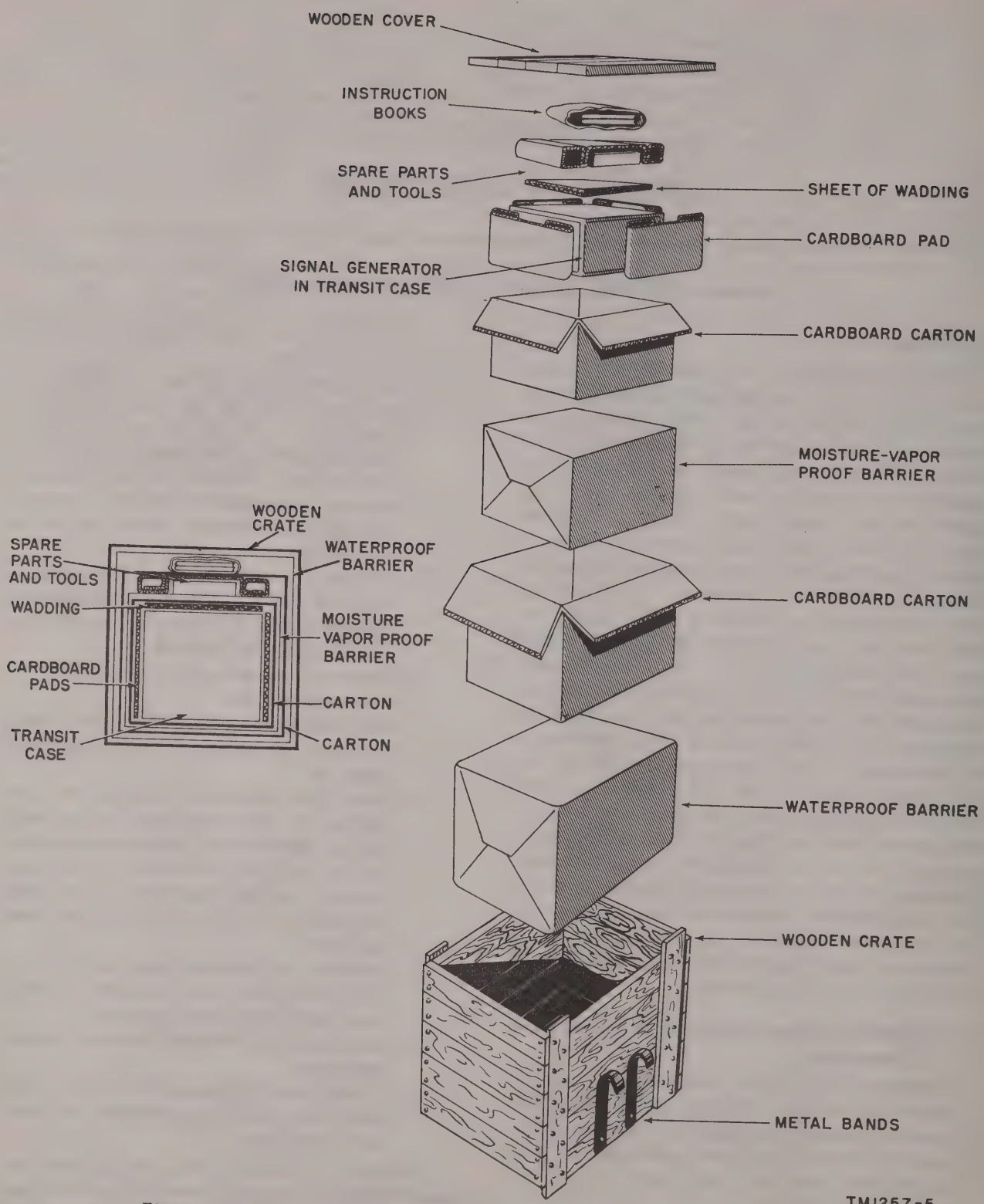

Figure 4. Typical packaging and packing of Signal Generator AN/URM–48.

be checked against the packing slip, which is found attached to the waterproof barrier or outer carton.

c. Repacking. If it is necessary to repack the signal generator and spare parts, the package should be made of the original packing materials. When closing the inner carton, use the same amount (approximately 9 pounds) of fresh (dry) silica gel. The moisture-vaporproof bag and waterproof barrier should be sealed with a tape that is designed for this type of seal. Be sure to include material between the cartons so that there will be no chance of the inner parts of the package moving around.

15. Installation

Before installing the signal generator, remove the chassis and the front panel from the dust cover to check for broken or misplaced tubes, bent shafts, loose wires, and other defects. (See fig. 5 for tube locations.) Remove the chassis by unscrewing the four captive screws on the rear of the dust cover and pulling the front panel away from the dust cover. After the inspection is made and any broken parts are replaced or there seems to be no damage, the chassis may be replaced in the dust cover and the unit located in the operating position.

Caution: Be sure to use fuses of the specified rating when replacing 1-ampere fuses (fig. 7).

16. Connections

(fig. 6)

After the signal generator is installed in its operating position and assumed to be in good operating condition, connections may be made for testing. Be sure that the POWER switch is in the OFF position before any connections are made.

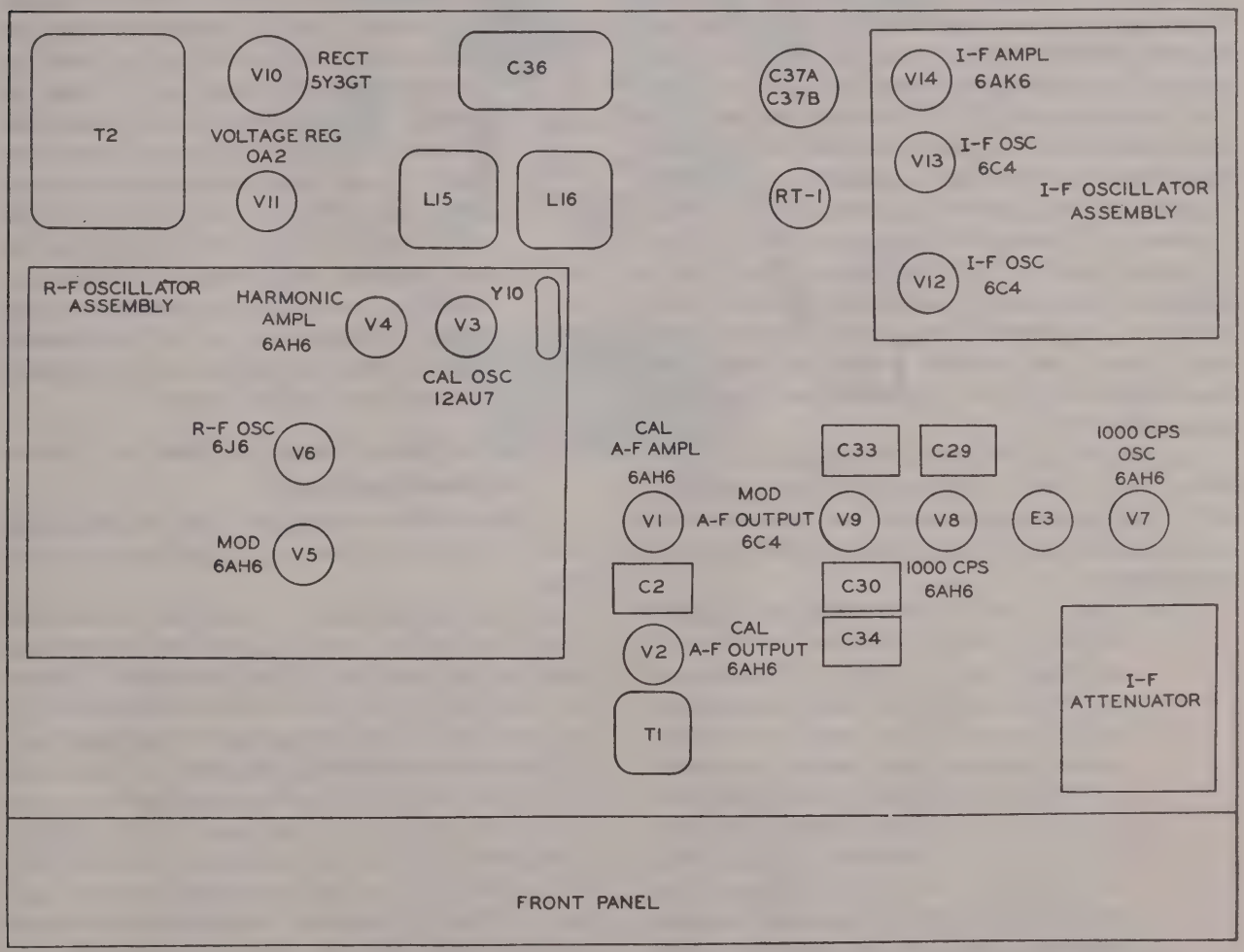

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Figure 5. Signal Generator SG–12/U, tube locations.

a. Power Connection. Determine the local power source voltage and frequency. The signal generator will operate on 115 or 230 volts and at any frequency between 50 and 1,000 cps. Voltage switch (S7) located under the front panel CAUTION plate must be in the proper position for the voltage to be used. Check the position of the switch by removing the CAUTION plate and observing which position the switch is in. Replace the CAUTION plate to indicate the correct switch position. The a-c line cord now may be plugged into a matching receptacle. When the cord is inserted, the orange neon HEATER ON lamp will light. If this does not occur, check the equipment performance checklist (par. 44) for the probable trouble.

b. External Audio Oscillator Connection. It is not necessary to use an external audio oscillator unless a rate of frequency deviation other than 1,000 cps is required. If an external audio oscillator is to be used, the 600-ohm input terminals marked EXT MOD (E1 and E2) must be connected to a matching output of the audio oscillator. The black terminal (GND) is grounded and is to be connected to the ground terminal at the audio generator. Input voltage necessary for operation from an external source is approximately an 8-volt sine wave. The connection may be made by means of twisted leads or a shielded wire. The latter is preferred, especially if the local electrical interference is great or long lengths of wires are necessary. Any hum or noise picked up from these input leads will cause distortion at the signal generator output.

c. R-f and I-f Output Cable Connections. The use of the i-f and r-f output cables is determined by the section or sections of the receiver to be tested and also the frequency range of the receivers being tested.

(1) The i-f cable is used when an i-f signal is to be supplied to the mixer or i-f amplifier of a receiver. Termination impedance at the i-f cable termination is 50 ohms. This may be applied directly across a grid resistor, or through a blocking capacitor when used with circuits above ground or those containing B+ voltages. Connection to the circuit is made by means of the alligator clips extending from the i-f cable-termination. The black lead is to be connected to the chassis or common ground at the receiver. The red lead is the hot lead which is connected to the grid or plate circuit. Specific points for connecting the i-f output cable may be found by referring to the appropriate alinement procedures in the technical manual covering the equipment under test.

(2) The r-f cable head (termination) has an output impedance of 10 ohms. It is used to supply modulated or unmodulated signals to the receiver in a frequency range of 20 to 100 mc. The output connection jack is the type commonly used on antenna lead-in coaxial cables for vhf (very-high frequency) radio receivers. With this type of connection, no clips or extra wires are needed to supply a signal directly into the antenna connector of the receiver. Electrical Dummy Load DA–69/URM–48 is connected to the r-f output cable when it is desired to simulate a whip antenna input into receiver being tested. When the signal is to be injected to some other part of the r-f stages, the binding-post-type terminals (E4 and E5, fig. 48) on the r-f head, are used. Short wires are clipped onto these terminals and then connected into the r-f circuit. If there is any chance of B+ voltages arcing across the cable termination, or of the low resistance of the head shorting out an avc (automatic volume control) voltage, a series blocking capacitor should be used.

17. Service Upon Receipt of Used or Reconditioned Equipment

a. Refer to the instructions given in paragraph 14 when unpacking used or reconditioned equipment.

b. If used equipment is received for service, check for tags or other sources of information regarding the condition of the equipment. When the condition is doubtful and no information is available, subject the equipment to the final testing procedures described in chapter 5. These final testing procedures will indicate whether the equipment is functioning as designed. A thoroughly reconditioned piece of equipment can be considered to be in the same condition as new equipment. When information is available to indicate that the signal generator is operating satisfactorily, it may be put into operation as described in paragraphs 20 through 25.

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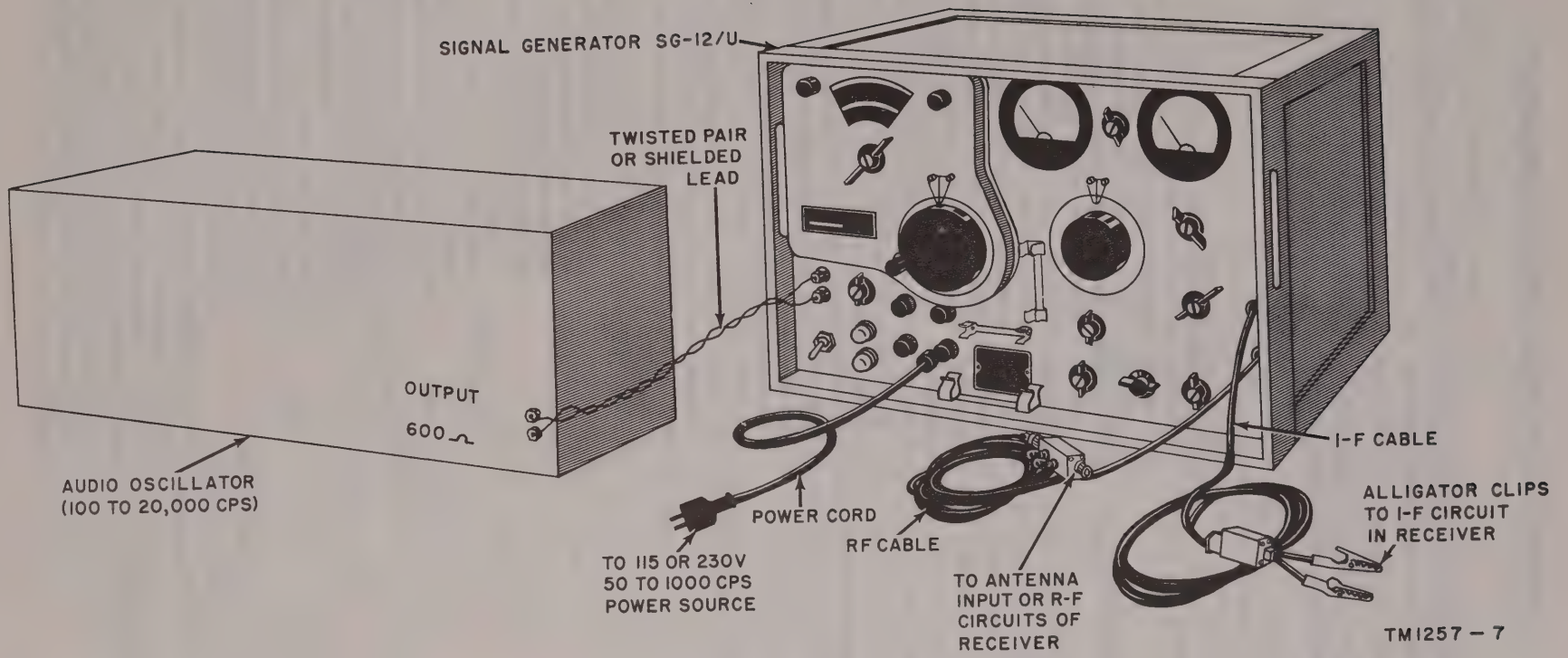
SIGNAL GENERATOR SG-12/U
TWISTED PAIR OR SHIELDED LEAD
OUTPUT
600 Ω
AUDIO OSCILLATOR (100 TO 20,000 CPS)
POWER CORD
TO 115 OR 230V 50 TO 1000 CPS POWER SOURCE
RF CABLE
TO ANTENNA INPUT OR R-F CIRCUITS OF RECEIVER
I-F CABLE
ALLIGATOR CLIPS TO I-F CIRCUIT IN RECEIVER
TM1257 – 7

Figure 6. Connections for Signal Generator SG–12/U.

Section II. CONTROLS AND INSTRUMENTS

18. General

Haphazard operation or improper setting of the controls can cause damage to the signal generator. To prevent such damage, it is important to know the function of all the front panel controls, meters, and terminals. The actual operation of the equipment is discussed in section III of this chapter.

19. Controls and Their Uses
(fig. 7)

The following chart lists the controls, meters, and terminations on the front panel of the signal generator and indicates their functions.

Control	Function
CAUTION plate	Covers toggle switch which permits either 115- or 230-volt operation.
POWER ON-OFF (S6) switch	Controls the a-c line voltage to the signal generator. In the OFF position, internal resistor-type heaters turn on to keep the signal generator warm and dry, provided the line is plugged in.
POWER ON (I 7) (pilot light)	This red pilot lamp lights when the POWER switch is ON and line voltage is applied to the power transformer.
HEATER ON (I 6) (pilot light)	This neon bulb lights when the resistor-type internal heaters are on.
BAND SWITCH	Selects the band containing the desired frequency in the range of 20 to 100 mc. A dial mask allows just one band at a time to be visible. There are five positions of the switch (A through E).
RF TUNING control	Tunes the desired frequency in each band selected by the BAND SWITCH. A dial lock is provided to hold the setting, once tuned.
CORRECTOR (C21)	Trims the oscillator frequency so that it corresponds to the frequency indicated on the dial scale. It is used in conjunction with the internal crystal calibrator.
DEVIATION RANGE switch (S3) 25–50–100	Selects one of three different frequency deviation ranges when an f-m output signal is used. The three ranges are 0 to 25 kc, 0 to 50 kc, and 0 to 100 kc.
DEVIATION LEVEL control (R49)	Adjusts the amount of frequency deviation within each of the three deviation ranges.
KILOCYCLES DEVIATION meter (M2)	This meter has three ranges corresponding to the ranges available with settings of the DEVIATION RANGE switch.
OPERATION switch (S1)	Determines the operation of the signal generator. It has the following 6 positions: B+ OFF — In this position, all high voltage is removed from the plate circuits, thereby disabling the signal generator. CAL — This position activates the 20- to 100-mc r-f section and places the calibration circuits in operation to provide check points for accurate calibration of the tuning dial. MOD OFF — In this position, the signal generator output is unmodulated and has the frequency range of 20 to 100 mc. 1000 — Provides an f-m output modulated at a 1,000-cps rate in the frequency range of 20 to 100 mc. EXT MOD — In this position, the internal 1,000-cps modulating oscillator is disconnected and the r-f oscillator can be modulated by an external source at the EXT MOD input terminals. IF — In this position, the high voltage is connected to only the i-f oscillator and amplifier circuits. This provides unmodulated crystal-controlled i-f output signals at the i-f output lead.
IF FREQUENCY MC switch (S8)	Selects the proper crystals and tuning circuits to provide the following output frequencies: 1.4, 2.515, 2.65, 2.88, 4.3, 4.45, 5.00, 5.35, and 15.0 mc. Two spare positions are provided for future use.
I. F. MICROVOLTS, R. F. SET TO LINE meter.	Used to indicate that the proper r-f voltage level is being fed into the r-f attenuator. Also used to indicate the i-f output voltage (the scale numbers, when multiplied by the IF MICROVOLTS attenuator setting, are the i-f output voltages).

Control	Function
RF SET TO LINE control	Adjusts and maintains a constant input level to the r-f attenuator.
RF ATTENUATOR MICROVOLTS control	Adjusts the r-f output signal between the limits of .05 to 10,000 μv as read on the control dial, when the needle on the R. F. SET TO LINE meter is set to the red line.
IF LEVEL control (R91)	Adjusts the i-f level to the attenuator.
IF MICROVOLTS attenuator (S4)	Reduces the output voltage in multiples of 10 (20-db steps) to the i-f output cable. In the OFF position, no i-f output can be taken from the signal generator.
EXT MOD terminals	These terminals are used to receive a modulation source other than the internal 1,000-cps oscillator to modulate the r-f oscillator tube. The frequency input should be between 100 and 20,000 cps. The ground terminal is marked GND.

Section III. OPERATION UNDER USUAL CONDITIONS

20. Starting Procedures

a. General. When the signal generator is connected to a power source with the POWER switch in the OFF position, internal resistor heaters will operate. Their operation will be indicated by the HEATER ON neon pilot lamp. When the POWER switch is turned ON, the resistor heaters are disconnected from the a-c line and the power transformer receives a-c power.

b. Preliminary Starting. Before attempting to operate the generator, place the controls in the following positions:

Control	Position
POWER	OFF.
RF SET TO LINE	Fully counterclockwise.
IF LEVEL	Fully counterclockwise.
DEVIATION LEVEL	Fully counterclockwise.
IF MICROVOLTS	OFF.
OPERATION switch	B+ OFF.

c. Starting. Set the POWER toggle switch to the ON position. The POWER ON pilot lamp and dial lamps should light. The HEATER ON pilot light will go off. If the HEATER ON light goes off but the dial and POWER ON lamps do not light, set the POWER switch to OFF and check for blown fuses (F1 and/or F2). If the indications are normal, allow a 5-minute warm-up period before proceeding further.

d. Generator Loading. Working the signal generator into low-impedance loads will cause erroneous indications on the front panel output meter. Corrections must be made when working the r-f output into loads of less than 80 ohms, and the i-f output into loads of less than 250 ohms. Corrections are tabulated below. Refer to figure 8 when it is necessary to convert output power from decibels below 1 watt to microvolts or vice versa. The chart has two curves to make it usable with both the r-f output termination and the i-f output termination. The 10-ohm curve is used for radio frequency; the 25-ohm curve for intermediate frequency.

(1) *R-f loading.*

Load impedance (Z_L)	Voltage across load (E_L)
Less than 80 ohms	$E_L=\frac{E_{ind}\times Z_L}{8+Z_L}$
Greater than 80 ohms	$E_L=E_{ind}$

(2) *I-f loading.*

Load impedance (Z_L)	Voltage across load (E_L)
Less than 250 ohms	$E_L=\frac{E_{ind}\times Z_L}{25+Z_L}$
Greater than 250 ohms	$E_L=E_{ind}$

Note. E_{ind} equals voltage indicated on panel meter.

21. Adjustments for C-W (Unmodulated) R-f Output (20 to 100 mc) Not Crystal-Calibrated

a. Determine the necessary test frequency.

b. Turn the CORRECTOR control knob until the white line on the knob lines up with the white line on the panel.

c. Turn the BAND SWITCH knob until the dial mask shows the band containing the desired frequency.

d. Release the RF TUNING dial lock by unscrewing until the RF TUNING knob can turn freely. Move the knob handle to a position where it will be at right angles to the panel.

e. Set the RF TUNING control to the desired frequency (between 20 and 100 mc) as shown by the direct reading dial scale.

f. Turn the OPERATION switch to the MOD OFF position.

g. Adjust the RF SET TO LINE control to make the right-hand meter needle cover the red line.

h. Turn the RF ATTENUATOR MICROVOLTS control until the desired output is indicated on the control dial.

i. Repeat *g* above if necessary.

22. R-F Output With Crystal-Calibrated Frequencies

a. Procedure. If precise settings of the r-f (20 to 100 mc) are required, the r-f oscillator can be corrected over small portions of the dial scale of each band by the use of the built-in crystal calibrator. When the crystal calibrator is used, it is necessary to interpolate between the marker frequencies in order to set the r-f oscillator to the exact desired frequency. The LINEAR SCALE (red) on the main tuning dial, which is used on all bands, makes the interpolation process easier. This linear calibration scale is marked from 0 to 5,000 in segments of 100 (50 marks). Each segment represents 1 complete revolution of the RF TUNING control, which is marked in 100 equally spaced divisions from 0 to 100 (LINEAR SCALE VERNIER). The vernier dial, therefore, turns 50 times to move the main dial across the complete scale. This provides a method of reading fractions of each segment and, therefore, gives an accuracy otherwise obtainable only with a much larger dial. The procedure for making precise settings of the r-f output using the crystal calibrator is as follows:

(1) Set the OPERATION switch to CAL.

(2) Determine the closest crystal calibration marker frequencies on both sides of the desired frequency. The crystal marker frequencies are at 2-mc intervals between approximately 60 and 102 mc, and 1-mc intervals from 20 to 60 mc.

(3) Set the RF TUNING control so that the *lower* crystal marker frequency reading on r-f dial scale appears directly under the hairline.

(4) Turn the CORRECTOR control to obtain a *zero beat* from the panel speaker. Once this control is set for the lower calibration point it *must not* be changed during the remainder of the indirect frequency setting procedure.

(5) Record the LINEAR SCALE and LINEAR SCALE VERNIER dial readings; the thousands and hundreds portion of the reading is found on the LINEAR SCALE of the tuning dial; the tens and units digits are read directly from the LINEAR SCALE VERNIER dial.

(6) The RF TUNING control then is turned until the nearest crystal marker point above the desired frequency is reached and *is indicated* by a zero beat from the panel speaker. Record the dial readings ((5) above).

(7) Subtract the reading obtained in (5) above from that obtained in (6) above.

(8) Subtract the lower crystal marker frequency from the desired frequency. Record the difference in mc.

(9) Multiply the figure obtained in (7) above by the figure obtained in (8) above.

(10) Divide the figure obtained in (9) above by the difference in mc between the lower and upper crystal marker frequencies (1 mc from 20 to 60 mc and 2 mc from 60 to 102 mc).

(11) The figure obtained in (10) above, when added to the figure obtained in (5) above, produces the LINEAR SCALE dial reading to which the LINEAR SCALE VERNIER must be tuned to obtain the desired r-f output.

b. Example. The desired frequency is 52.68 mc, which is located in band C (fig. 9).

(1) Tune the RF TUNING control to make the 52 mc mark fall directly under the hairline. Record the calibration scale reading of 3849, as read from the LIN EAR SCALE and LINEAR SCALE VERNIER.

(2) Tune the CORRECTOR for zero beat.

(3) Turn the RF TUNING near 53 mc until the zero-beat indication is heard again.

Record the calibration scale reading of 4119.

(4) Subtract 3849 from 4119; the difference is 270.

(5) The desired frequency, 52.68, minus the lower calibration frequency, 52 mc, equals .68. The difference, 270 ((4) above), times .68 equals 183.6.

(6) Add the number of divisions (183.6) to the 52-mc marker LINEAR SCALE reading (3849); the desired frequency is found at a LINEAR SCALE reading of 4032.6. The uncalibrated frequency reading shown on the band C dial scale happened to be 52.71 mc in this example.

(7) Tune the RF TUNING control to 4032.6 and the output of the signal generator will be exactly 52.68 mc.

23. Adjustments for F-M, R-F Output (20–100 mc)

a. Internal 1,000 Cps Modulation.

(1) Determine the amount of frequency deviation required, and set the DEVIATION RANGE switch to a position which will place the desired KILOCYCLES DEVIATION reading on the lowest scale.

(2) Turn the OPERATION switch to the 1000 ~ position.

(3) Adjust the DEVIATION LEVEL control until the KILOCYCLES DEVIATION meter indicates the desired deviation in kc.

(4) Proceed with paragraph 21*g* through *i*.

b. External Modulation. Before beginning this procedure, make sure the DEVIATION LEVEL control is fully counterclockwise.

(1) Apply an audio signal from a 600-ohm audio source to the EXT MOD terminals. Refer to paragraph 16 for directions on making the connections. The signal should be approximately 8 volts and at a frequency between 100 and 20,000 cps. In making the adjustments for using external modulation, follow the procedure in (2) through (6) below.

(2) Proceed with the steps described in paragraph 21*a* through *e* (or for crystal-calibrated frequencies substitute par. 22 for par. 21*e*).

(3) Determine the amount of frequency deviation required and set the DEVIATION RANGE switch to a position which will place the desired KILOCYCLES DEVIATION reading on the lowest scale.

(4) Set the OPERATION switch to the EXT MOD position.

(5) Adjust the DEVIATION LEVEL control until the KILOCYCLES DEVIATION meter indicates the desired deviation in kc.

(6) Proceed with the r-f attenuator settings described in paragraph 21*g* through *i*.

24. I-f Output (Unmodulated)

a. Turn the OPERATION switch to the IF position.

b. Set the IF FREQUENCY MC switch to the desired intermediate frequency.

c. The reading on the upper scale of the I. F. MICROVOLTS meter when multiplied by the IF MICROVOLTS attenuator reading indicates the number of microvolts being supplied at the i-f output termination head.

Example:

Meter reading .5, IF MICROVOLTS attenuator setting 1K.

I-f output .5 x 1,000, or 500 uv.

Each step on the IF MICROVOLTS attenuator is a 20-db (voltage ratio of 10 to 1) change in level. Set both the IF LEVEL control and IF MICROVOLTS attenuator to obtain the desired i-f output voltage.

25. Stopping Procedure

To stop the signal generator, place the POWER switch in the OFF position. The POWER ON pilot light will go off and the HEATER ON neon pilot light will light. Turn the RF SET TO LINE and IF LEVEL controls to their extreme counterclockwise positions. Turn the OPERATION switch to the B+ OFF position.

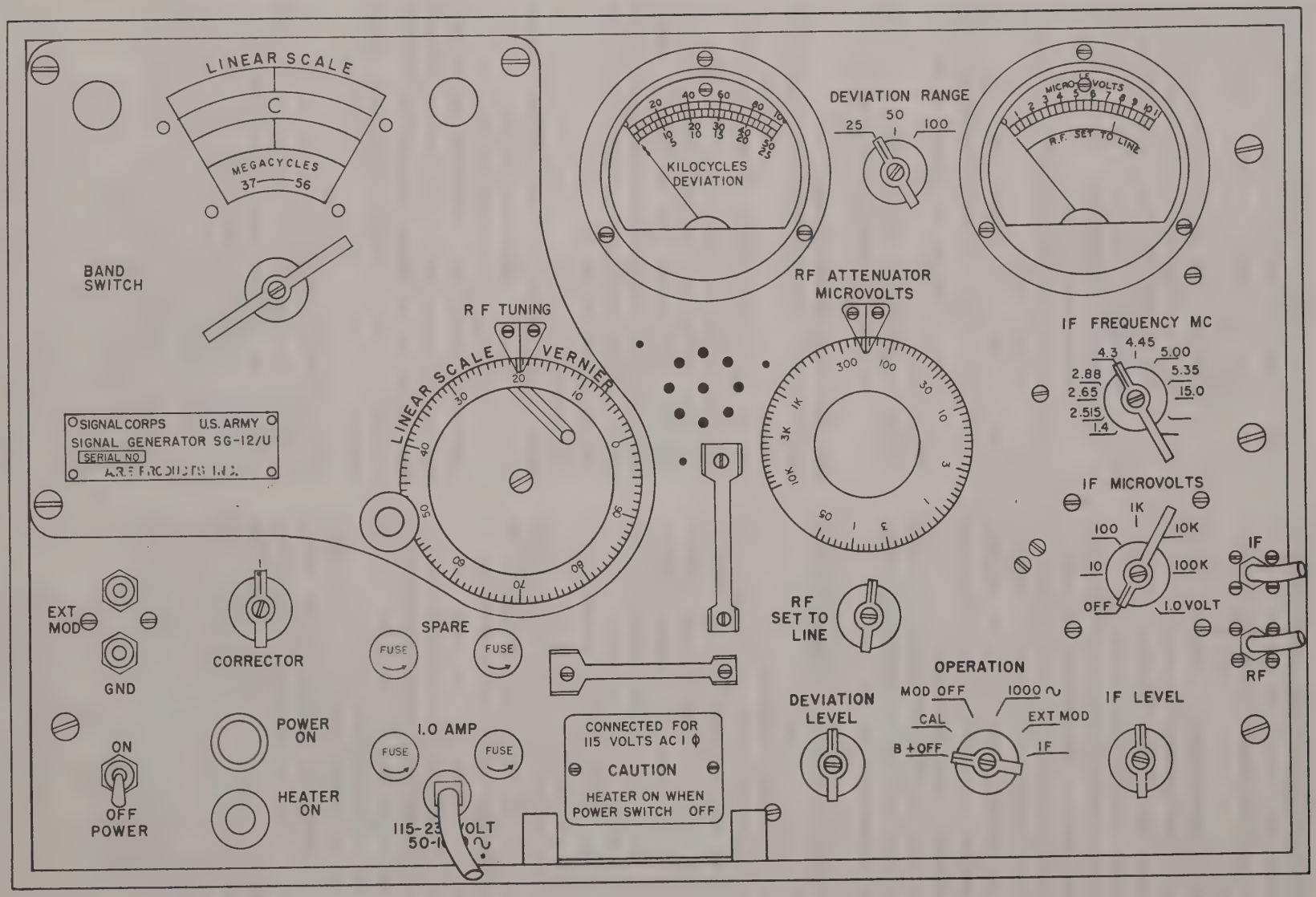

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Figure 7. Signal Generator SG–12/U, front panel view.

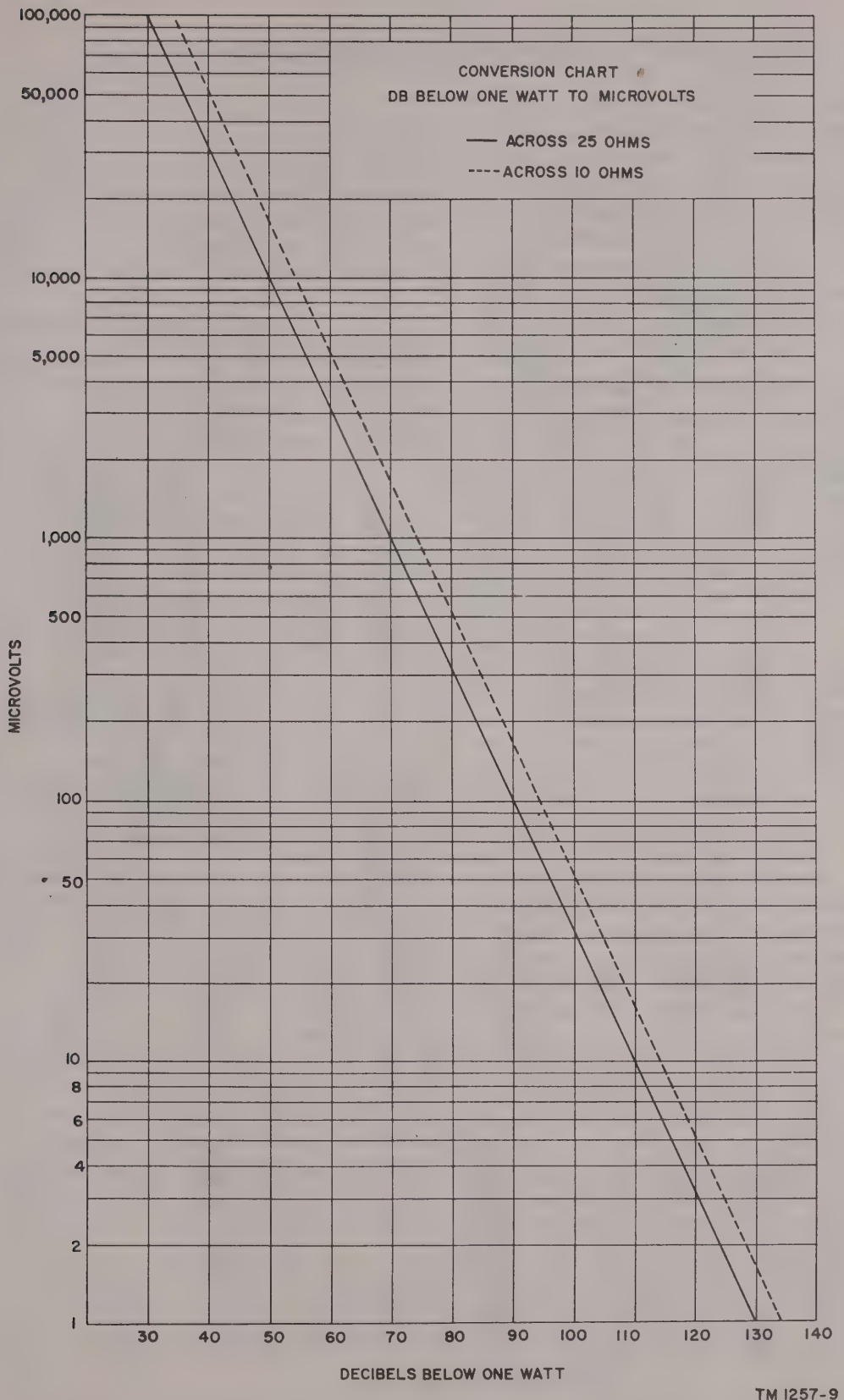

Figure 8. Conversion chart, db below 1 watt to microvolts.

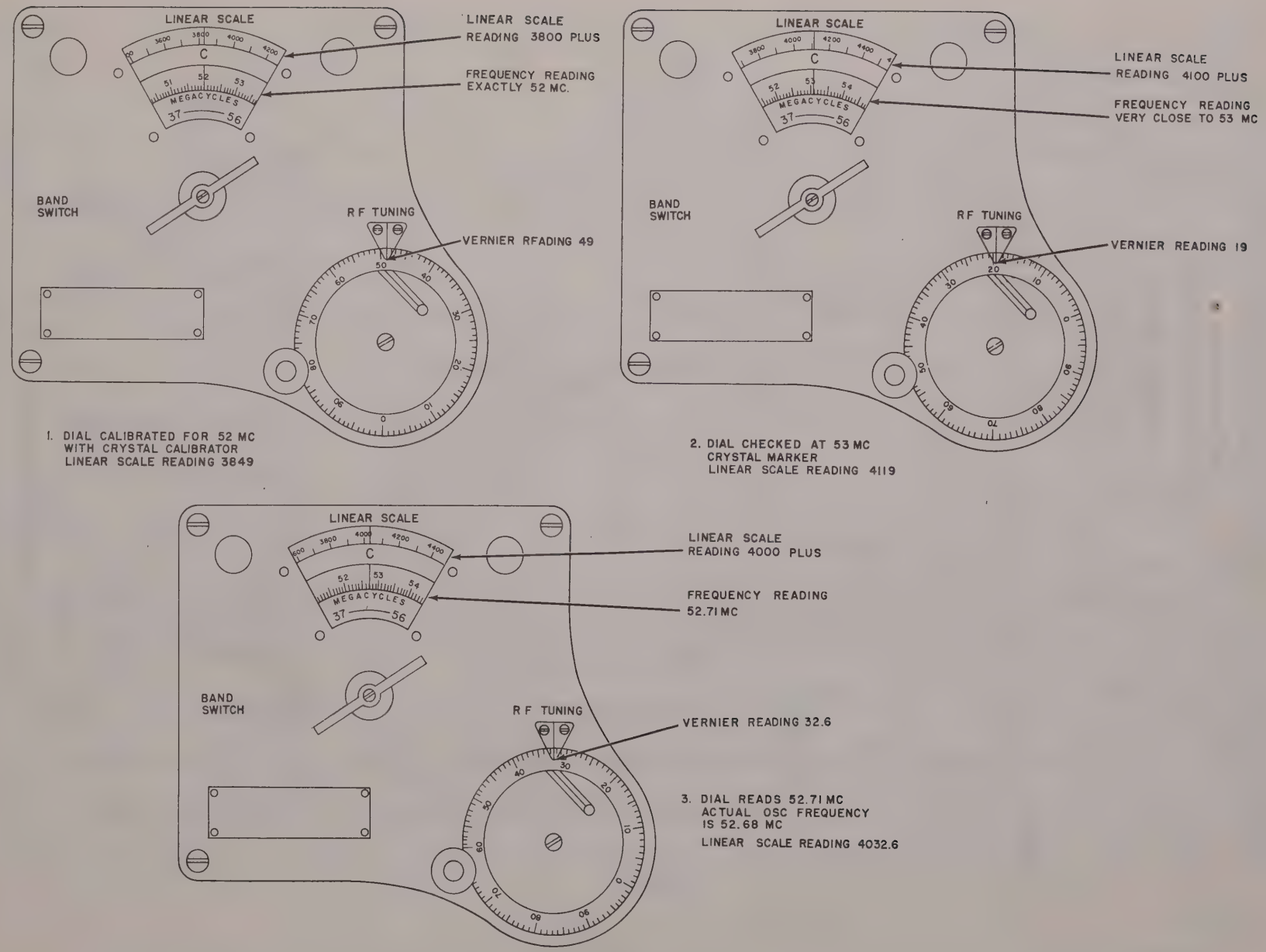
LINEAR SCALE
LINEAR SCALE READING 3800 PLUS
FREQUENCY READING EXACTLY 52 MC.
BAND SWITCH
RF TUNING
VERNIER RFADING 49
1. DIAL CALIBRATED FOR 52 MC WITH CRYSTAL CALIBRATOR LINEAR SCALE READING 3849
LINEAR SCALE
LINEAR SCALE READING 4100 PLUS
FREQUENCY READING VERY CLOSE TO 53 MC
BAND SWITCH
RF TUNING
VERNIER READING 19
2. DIAL CHECKED AT 53 MC CRYSTAL MARKER LINEAR SCALE READING 4119
LINEAR SCALE
LINEAR SCALE READING 4000 PLUS
FREQUENCY READING 52.71 MC
BAND SWITCH
RF TUNING
VERNIER READING 32.6
3. DIAL READS 52.71 MC ACTUAL OSC FREQUENCY IS 52.68 MC
LINEAR SCALE READING 4032.6
MEGACYCLES
TM 1257-44

Figure 9. Indirect frequency setting.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

26. General

The operation of Signal Generator SG--12/U may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In paragraphs 27 through 29, instructions are given on procedures for minimizing the effect of these unusual operating conditions.

27. Operation in Arctic Climates

Subzero temperatures in climatic conditions associated with cold weather affect the efficient operation of equipment. Instructions and precautions for operation under such adverse conditions follow in *a* through *c* below.

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. Built-in heater resistors keep the ambient temperature inside the dust cover a few degrees above room temperature, thereby minimizing condensation due to the cooling effect on moisture of the inclosed air. These heaters are on when the POWER switch is in the OFF position. Always keep the line cord plugged into the power source and the POWER switch in the OFF position when the equipment is not being used. If necessary, the signal generator may be left in the POWER ON position with the OPERATION switch set to the B+ OFF position. With the signal generator in the condition described above, all the tube filaments will be heated and will provide more heat than can be radiated by the built-in resistors. This will also eliminate excessively long warm-up periods when use of the signal generator is not frequent.

c. When equipment has been exposed to the cold and is brought into a warm room, it will sweat until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

28. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground, and when it is set up in swampy areas, moisture conditions are more acute than normal. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than that of the ambient air. To minimize this condition, keep the signal generator in the POWER ON position continuously with the OPERATION switch in the B+ OFF position.

29. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment. A common condition in desert areas is a high temperature during the day and a large drop in temperature during the night because most of the heat is reflected and not absorbed by the sands. This leads to condensation of moisture.

b. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, and dirt that enters the moving parts of radio equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building often is not available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors and cover the inside walls with heavy paper. If a tent is used, secure the side walls of the tent with sand to prevent their flapping in the wind.

c. Never tie power cords or other wiring connections to either the inside or outside of tents. Desert areas are subject to sudden squalls which may break the connections loose or break the wires.

d. Be careful that the equipment is as free from dust as possible. Make frequent preventive maintenance checks (ch. 3). Pay close attention to the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil or grease result in grit which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

30. Tools Supplied with Equipment

Most of the repair or maintenance may be made with tools found in the average tool kit. No tools are supplied with Signal Generator AN/URM–48.

31. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair since its object is to prevent certain troubles from occurring. See AR 750–5.

32. General Preventive Maintenance Techniques

a. Use No. C0G sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) Clean all parts, except electrical contacts, with a cloth or brush moistened with Solvent, Dry Cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of fumes is dangerous. Make sure adequate ventilation is provided.

(3) To clean turret contacts, insert a strip of clean bond paper while turning the turret to the next position. Then pull the paper from between the contacts. Do this for all bands. Do not use abrasive paper for this purpose. Abrasives will damage the silver plating on the turret contacts.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

33. Use of Preventive Maintenance Forms (figs. 10 and 11)

a. The information in paragraph 34 is presented as a guide to the individual making an inspection of equipment in accordance with instructions on DA Forms 11–238 and 11–239. The decision as to which items on the forms are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communications officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 10 and 11 are partially or totally applicable to the performance of preventive maintenance on Signal Generator AN/URM–48. Paragraphs giving further instructions and explanations are referenced under the item number for each applicable item.

34. Performing Preventive Maintenance

a. External Preventive Maintenance.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken. Be especially careful of any screws which are threaded into a plastic or bakelite material since the threads may be stripped easily.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; Ⓧ Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR. 34a(1)							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 34a(2)							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 34b(1)							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 34a(3)							
6	CHECK FOR NORMAL OPERATION. PAR 34a(4)							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 34a(7)		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR.34a(5)		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 34a(7)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 34a(6)		15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 34a(7)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR 39	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 34a(8)		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA AGO FORM 1 MAY 51 11-238 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

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Figure 10. DA AGO Form 11–238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE | EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR. 34a(1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 34a(2)	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 34b(1)	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 34a(3)	
6	CHECK FOR NORMAL OPERATION. PAR. 34a(4)	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 34a(7)	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 34a(5)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 34a(6)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 34a(8)	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 34a(7)	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 34a(7)	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 39	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	
19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR. 34b(1)	
20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 34b(2)	
22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	
23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 34b(3)	
24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 34b(4)	
25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 34b(2), (4)	
26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 34b(5)	
27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR. 34b(4)	
28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER. PAR. 34	
30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 34b(7)	
32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 34b(7)	
33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
37	MOISTURE AND FUNGIPROOF. PAR. 34b(9)	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.	

DA AGO FORM 1 MAY 51 11-239 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 60—16—64382-1

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Figure 11. DA AGO Form 11-239.

(1) Check the completeness of the equipment against the list of components in paragraph 7.
(2) Remove dirt and moisture from all the equipment components.
(3) Inspect the front panel controls for ease of rotation, positiveness and alinement of detents, and security of the knobs.
(4) Check for normal operation following the instructions outlined in paragraph 20 through 25 and the equipment performance checklist (par. 44).
(5) Inspect the signal generator case and its carrying case for rust and corrosion on all exposed metal surfaces. Refer to paragraphs 39 and 40 for corrective measures.
(6) Inspect the a-c input and r-f and i-f output cables for cuts, breaks, deterioration, and kinks.
(7) Clean the equipment nameplates, exposed labels, and dial and meter windows. Check to see that the dial and meter windows, exposed meter cases, and control knobs are not cracked or broken. Tighten exterior of component.
(8) Check for looseness of accessible switches, knobs, jacks, and connectors.

b. Internal Preventive Maintenance.

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

(1) Inspect seating of pluck-out items: tubes, lamps, crystal CR2, fuses, etc. As the tube seating is checked, examine the tubes for loose envelopes, cracked sockets, and bent or broken pins. See figures 32 and 33 for tube locations.
(2) Inspect fixed capacitors for leaks, bulges, and discoloration. Check the capacitor terminals for corrosion, dirt, and loose contacts. See figures 13, 14, 33, 35, 36, 37, and 40 for capacitor locations.
(3) Inspect variable capacitors C21, C24, and C25 for dirt, moisture, loose mountings, and misalinement of plates. Refer to figures 34 and 35 for capacitor locations.
(4) Inspect resistors, bushings, and terminal boards for cracks, blistering discoloration, and moisture. Check resistor terminals for corrosion and looseness. See figure 40 for terminal board locations.
(5) Clean and tighten switches, terminal blocks, and interior mountings of chassis not readily accessible.
(6) Lubricate the equipment in accordance with instructions in Section II, this chapter.
(7) Clean and tighten connections and mountings for transformers, chokes, and potentiometers. Inspect the units for signs of overheating. Refer to figures 13, 14, 32, 33, 34, and 35 for component locations.
(8) Check gears for loose setscrews and damaged teeth. Check the r-f and i-f turret contacts for cleanliness and proper making.
(9) Check the moisture and fungiproofing varnish for chipping, cracking, or blistering (par. 39).

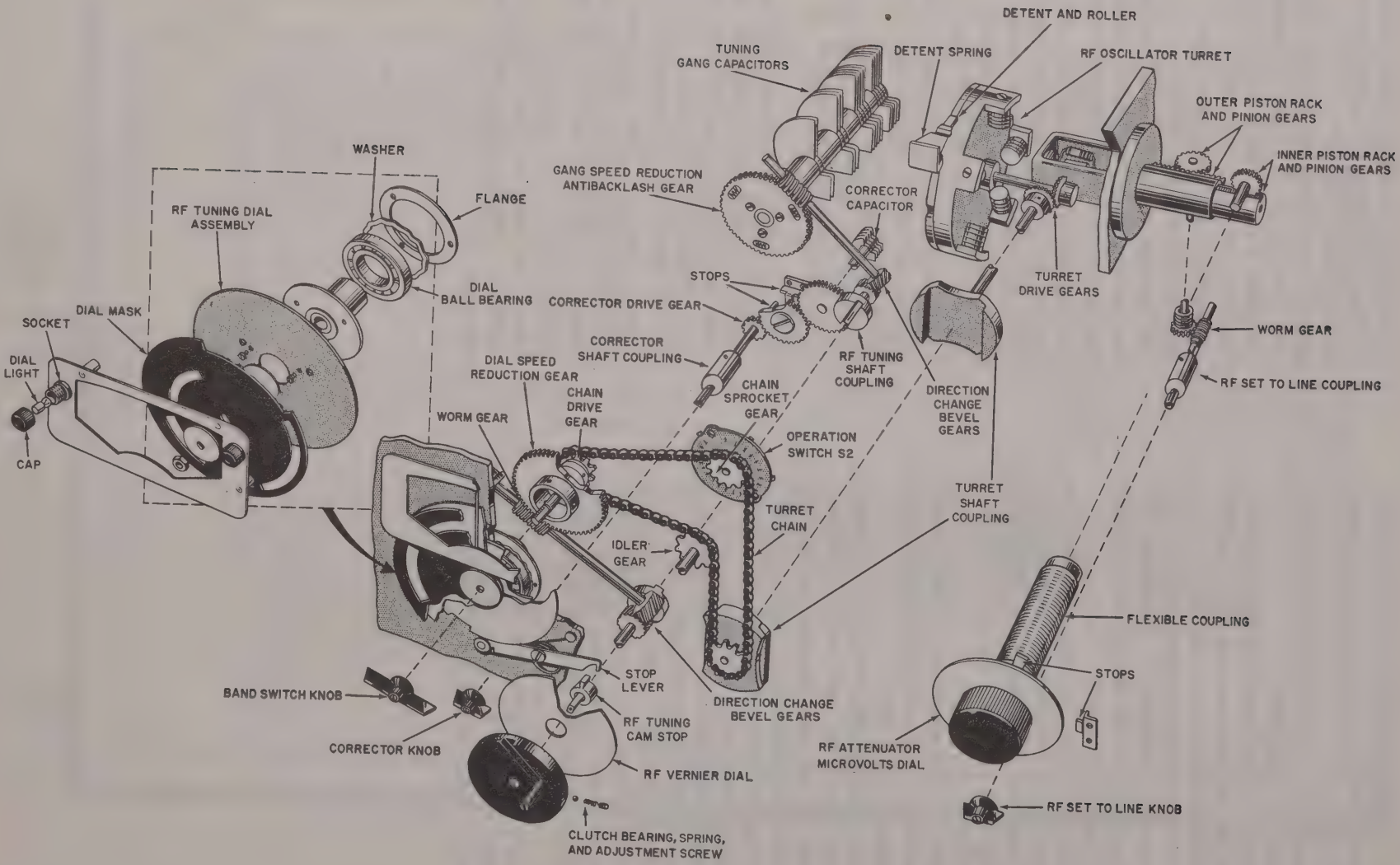

Figure 12. Functional diagram of mechanical components for tuning

TM1257-10

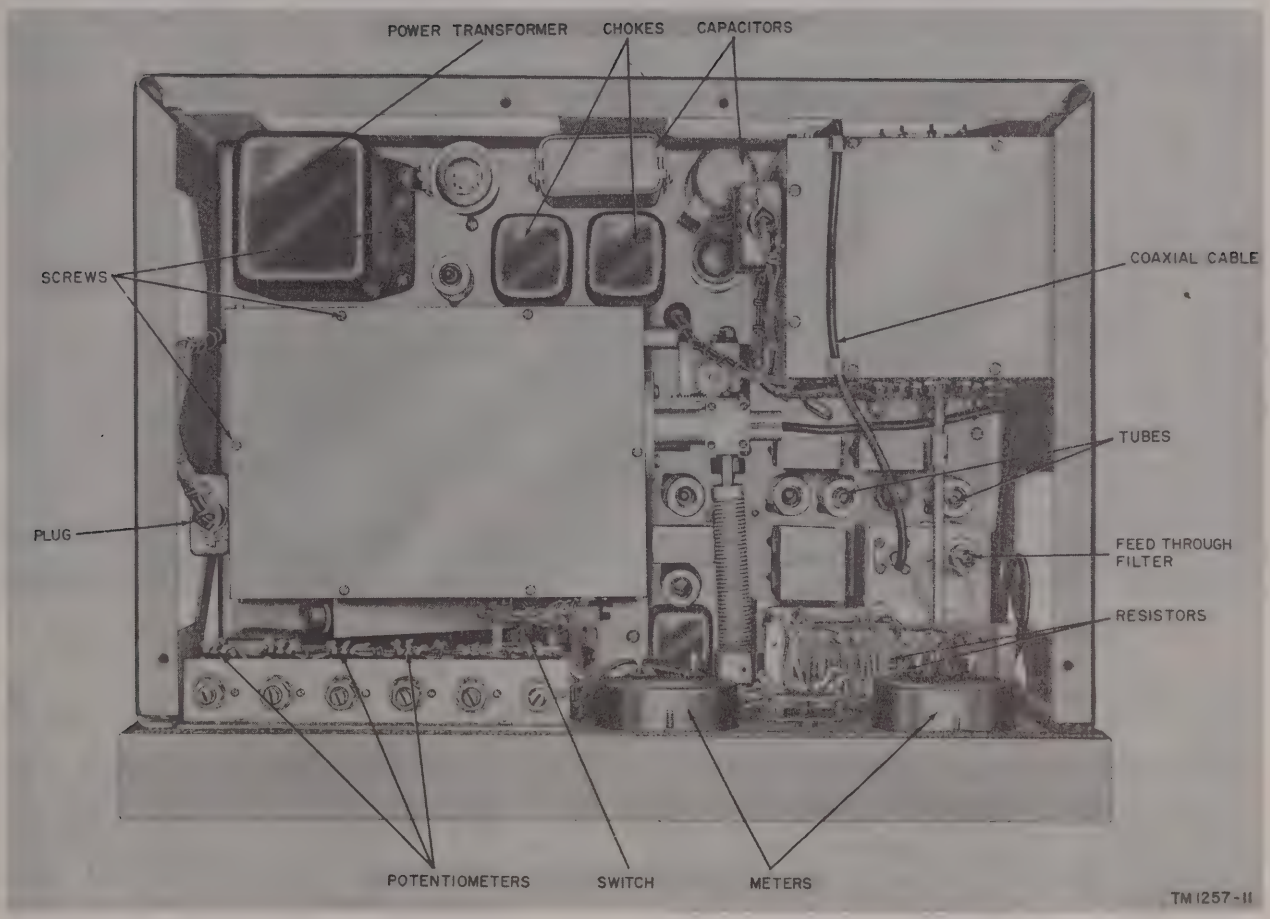

Figure 13. Signal Generator SG–12/U, top view, showing typical preventive maintenance items.

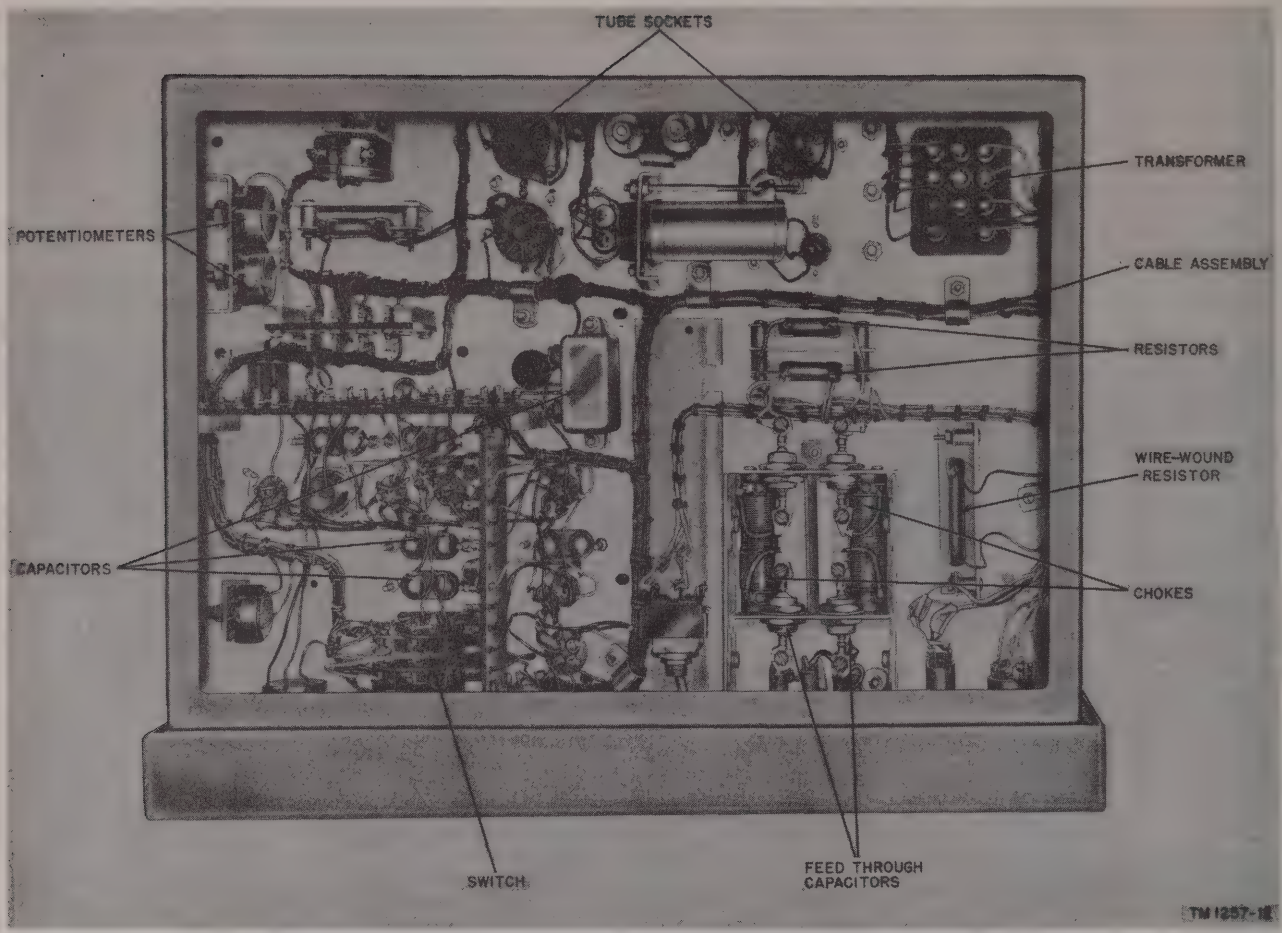

Figure 14. Signal Generator SG–12/U, bottom view, showing typical preventive maintenance items.

Section II. LUBRICATION

35. General Lubrication Instructions

a. Several factors determine the frequency with which parts in the signal generator need to be lubricated. These factors are—

(1) After a certain length of time, most lubricants become wax-like and cake up in spots so that they will not give the proper lubrication. In these cases, the old lubricant should be cleaned off and a new lubricant applied.

(2) The signal generator may be operated in a location where extreme temperature changes occur; the lubricant then will be hard because of low temperatures when the signal generator is not in operation and extremely soft or liquid when the signal generator is operating and the temperature rises. Where the temperature change is great, the condition of the lubricants must be inspected frequently.

(3) In some locations, the foreign materials present in the air, such as dirt, sand, smoke, metal filings, or gases, may enter the signal generator and mix with the lubricant and form a grit, or decompose the lubricant. If grit is formed, it will act as an abrasive and cause serious wear. The old lubricant should be cleaned away thoroughly with solvent (SD) and fresh lubricant applied frequently.

(4) Although the signal generator is protected against humidity, a certain amount of moisture may enter and injure the moving parts. Moisture condensation is prevalent when the temperature drops quickly and the relative humidity is high. If

the signal generator is not connected to the power source during this period, the moisture will condense on the parts of the signal generator and may penetrate where proper lubrication procedure is not practiced. If such a condition occurs near an ocean or salty body of water, on evaporation of the moisture, a salt will be left which will cause corrosion.

b. Be careful of the amount of lubricant applied. Excessive lubrication may drip or spread the lubricant to portions of the signal generator where it can cause poor electrical contact and instability of operation. Sometimes lubricant cannot be forced between two moving parts. To apply a lubricant to these parts, it is necessary to disassemble, lubricate, and then reassemble the parts. The best time to do this is when the parts are being reassembled after repairs or when they are being replaced. Common sense and experience will indicate the best lubrication procedures for the type of installation and location being used.

36. Parts Lubricated by Manufacturer

During assembly of the signal generator, certain parts are lubricated. Lubrication is applied to all moving metal parts that are not used for electrical contact. These parts consist of all gears, shafts, bushings, bearings, etc., throughout the signal generator. Figure 15 shows the areas that have lubrication points.

37. Parts to be Lubricated

The parts to be lubricated are the same as those lubricated by the manufacturer. Most of the lubrication points are above the chassis. The only points below the chassis are the OPERATION switch (S2) bushings. Specific points to be lubricated are given below:

a. Turret Drive Mechanism. The shafts, gears, and chain of the turret drive mechanism are shown in figure 12. Where the shafts pass through bushings, bearings, or castings, a thin coat of Grease, Aircraft and Instruments (GL) should be applied. To do this, it may be necessary to disassemble parts of the turret drive mechanism. Lubricate the meshing teeth of all gears. Carefully lubricate the bevel gears inside the r-f assembly which turn the turret. Also lubricate the detent roller and detent plate. Lubricate shaft bushings with Oil, Lubricating, Preservative, Special (PL Special). Be careful not to drop the lubricant on any components or between connections since this could cause changing of capacitance or resistance which could affect the calibration of the r-f oscillator assembly.

b. R-F Tuning Dial Drive. Figure 12 shows the sequence of shafts and gears for the r-f tuning dial and r-f tuning capacitor gang. There are several gears and shafts that are partially inclosed in castings, therefore, some disassembly may be necessary to lubricate adequately all gear teeth. The r-f tuning dial must be disassembled to lubricate the ball bearing on the dial shaft.

c. R-F Attenuator Drive. The r-f attenuator consists of two separate gear drives; one working from the RF ATTENUATOR MICROVOLTS control knob, the other working from the RF SET TO LINE control knob. Both controls have a series of shafts and gears which eventually operate the racks and pinion gears which slide the attenuator pistons. These racks and pinion gears must be lubricated; however, be careful to prevent the lubricant from entering between the concentric attenuator tubes.

d. Corrector Capacitor Drive. The CORRECTOR capacitor drive has three gears, requiring lubrication, and two shaft bushings.

38. Lubrication Under Unusual Conditions

a. Arctic Regions. Lubricants which are satisfactory at moderate temperatures stiffen and solidify at subzero temperatures; as a result, moving parts bind or become inoperative. Consult the key on the lubrication order for the proper grade of lubricant for operating the equipment in arctic regions. When preparing the equipment for low-temperature operation, see that lubricants used for moderate temperatures are thoroughly removed. Even small amounts of such lubricants, if allowed to remain, may impair the operation of moving parts. Be sure to use the lubricant specified for low-temperature operation.

b. Tropical Regions. High temperatures and moisture caused by rain, condensation, etc., may cause lubricants which are normally satisfactory to flow from moving parts and other surfaces. These bearing surfaces will wear excessively, and hinges, fasteners, and other parts will be damaged or destroyed by rust and corrosion. Inspect the

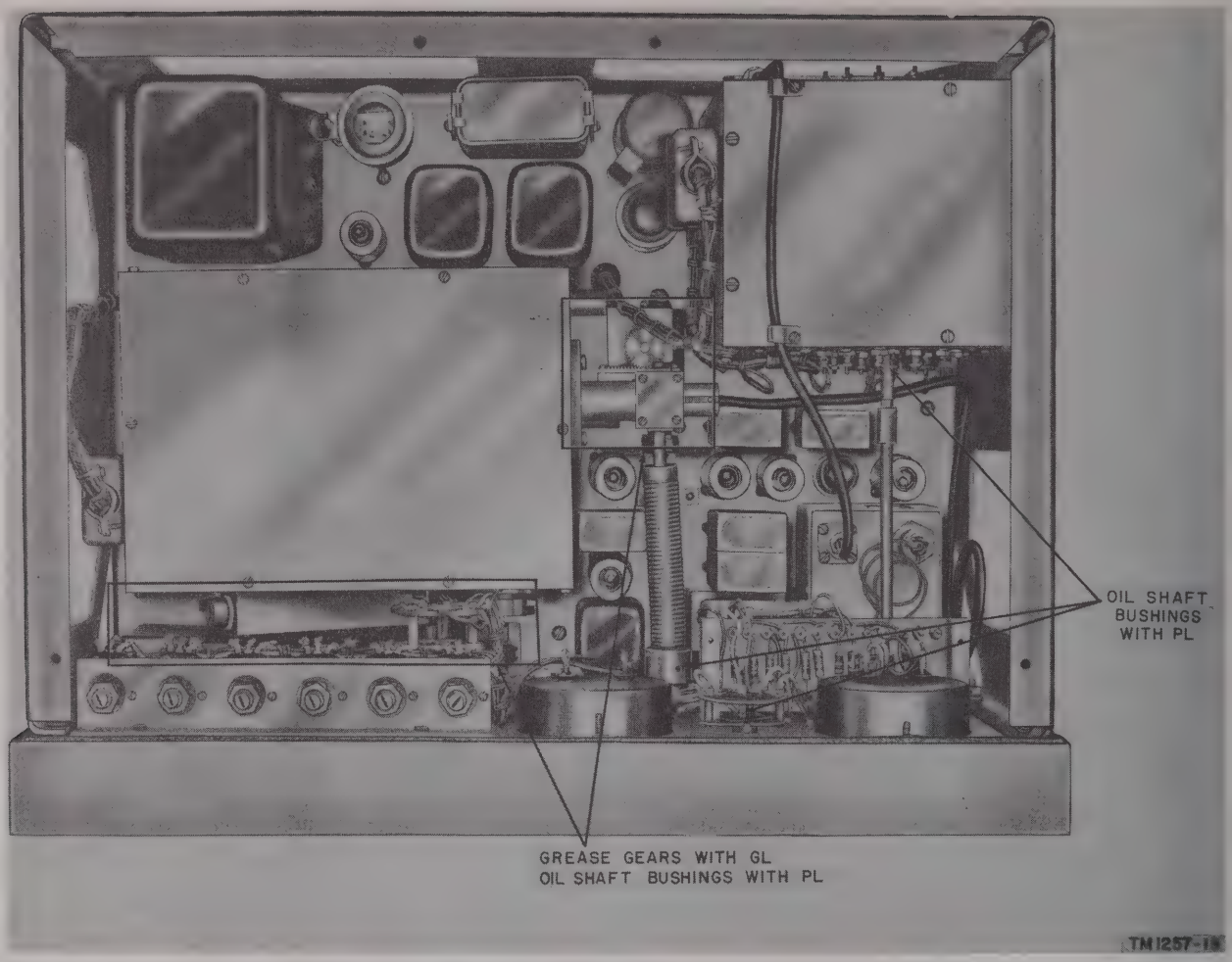

Figure 15. Top of chassis showing lubrication points.

equipment daily and lubricate it as required to insure efficient operation; use lubricants suitable for high temperatures.

c. Desert Regions. Dust and sand infiltration into the equipment causes grit in the lubricants and will impair and damage seriously the moving parts of the signal generator. Hot, dry temperatures cause the lubricants to flow from the moving parts, and conditions similar to those described in *b* above will result. Use lubricants suitable for high temperatures. Inspect and clean the equipment daily.

Section III. WEATHERPROOFING

39. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moisture-proofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas

subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

e. Lubrication. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat. Refer to paragraphs 35 through 38 for detailed instructions.

40. Rustproofing and Painting

a. A badly scarred or damaged front panel or dust cover may be touched up so that its bared surface will not corrode. Clean the surface down to the bare metal, using No. 00 or No. 000 sandpaper; obtain a smooth metallic finish.

Caution: Do not use steel wool. Minute particles frequently enter the signal generator and cause harmful internal shorting or grounding of circuits.

b. Apply the touch-up paint to the bared surface with a small brush. Before doing so, remove any rust or corrosion from the metal surface by cleaning with solvent (SD). In some severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper before the metal may be painted. Paint used will be authorized and consistent with existing regulations.

Section IV. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

41. Scope

a. The troubleshooting and repair work to be performed at organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such troubles as defective tubes, broken cables, broken resistors, burned-out fuses, etc.

b. Paragraphs 42 through 44 help in determining which of the stages is defective and in localizing the fault in that stage to the defective item, such as a tube or fuse.

42. Visual Inspection

a. Equipment troubles may be caused by one or more of the following conditions:

(1) Loose or disconnected power source cable.
(2) Poor connections at input or output cables or wires.
(3) Burned-out fuse or fuses.
(4) Defective tubes.
(5) Inactive (dirty or cracked) crystal.
(6) Improper position of a-c line-voltage switch behind CAUTION plate.

b. When a failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the signal generator. If possible, obtain information from the operator of the equipment regarding performances at the time the trouble occurred.

c. Check anything that seems to have an abnormal color which may have been caused by overheating or corrosion.

43. Troubleshooting by Using Equipment Performance Checklist

a. General. The equipment performance checklist (par. 44) will help the operator to locate trouble in the equipment. This list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items, it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those the operator can make without

turning in the equipment for repairs. In the equipment performance checklist, reference to chapter 5 indicates that the trouble cannot be corrected during operation and that troubleshooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, troubleshooting is necessary.

44. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	R-f or i-f cable.	Connected to unit under test.		
	2	POWER switch.	Set at OFF.		
	3	Line cord.	Line cord connected to power source.	HEATER ON lamp lights.	Check power source. Check fuse F1 and/or F2. Check HEATER ON lamp.
	4	OPERATION switch.	Set at B+ OFF.		
	5	CORRECTOR control.	Set at line.		
START	6	POWER switch.	Move to ON position.	POWER ON and dial lamps light.	Check lamps. Check chassis cable connectors J8 and P8 for tightness.
EQUIPMENT PERFORMANCE	7	OPERATION switch.	Set to CAL.	Noise is heard from speaker. When the RF TUNING control is tuned, audio beats are heard from speaker on all five r-f bands.	Check tubes V1, V2, V3, V4, V6, V10, and crystal Y10. Check interconnections J7 and P7 for tightness. Refer to chapter 5.
			Set at MOD OFF.	R-f is fed to the unit under test. Needle on IF MICROVOLTS meter varies with the setting of the RF SET TO LINE control.	Check tube V6. Refer to chapter 5.
			Set at 1000~.	R-f is fed to the unit under test with frequency modulation of 1,000 cps. KILOCYCLES DEVIATION meter indication varies with setting of DEVIATION LEVEL control.	Check tubes V5, V7, V8, V9, and lamp E3. Refer to chapter 5.
			Set to EXT MOD. External audio oscillator connected to EXT MOD terminals.	R-f signal is fed to unit under test with an f-m rate determined by external audio oscillator. KILOCYCLES DEVIATION meter indication varies with setting of audio oscillator output and DEVIATION LEVEL control.	Check connection to EXT MOD terminals. Refer to chapter 5.

44. Equipment Performance Checklist—Continued

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	7	OPERATION switch.	Set at IF.	I-f signals are fed to unit under test for any setting of IF FREQUENCY MC switch with the IF MICROVOLTS attenuator in any position but OFF and the IF MICROVOLTS meter indication varies with the setting of the IF LEVEL control.	Check tubes V12, V13, and V14. Check interconnections J9 and P9 and coaxial connections to and from the i-f attenuator assembly. Refer to chapter 5.
STOP	8	POWER switch.	Move to OFF position.	POWER ON and dial lamps go out and HEATER ON lamp lights.	Check HEATER ON lamp.

CHAPTER 4
THEORY

45. Introduction

This chapter contains detailed explanations of the circuits in the signal generator. It will aid the repairman in understanding the circuits that appear complex, since a paragraph and a schematic diagram are devoted to each stage. With the knowledge gained from this chapter, trouble-shooting will be made easier, and the work will be done more efficiently.

46. Block Diagram

The block diagram of Signal Generator SG–12/U is shown in figure 16. For more detailed overall circuit information, refer to figures 48 and 49. The signal paths through the signal generator as shown in the block diagram are described briefly below.

a. Calibration Oscillator. The calibration oscillator stage is crystal-controlled and operates at a frequency of 2 mc. Oscillator tube V3 is a dual-triode 12AU7. The two triode sections are connected in a manner similar to a multivibrator circuit and are cathode coupled with a 2-mc crystal. The output that is developed in this stage is fed to harmonic amplifier stage V4.

b. Harmonic Amplifier. The harmonic amplifier stage takes the 2-mc, r-f signal from the calibration oscillator stage and amplifies it and its many harmonics. The harmonics are used to beat against the output signals of the r-f oscillator tube as a check on the r-f oscillator frequencies. The beat frequencies are monitored by means of the front panel speaker.

c. Modulator. Modulator stage V5 uses a high-conductance-type pentode tube and frequency modulates the r-f output of the signal generator. The tube is connected as a variable reactance in the r-f oscillator tank circuit and varies the resonant frequency of the tank. The changes which take place at the reactance tube cause the r-f oscillator frequency to deviate from its center frequency. The amount of deviation is determined by the amplitude of the modulating signal fed to the grid of the modulator from the a-f circuit. The frequency deviation rate is determined by the frequency of the a-f signal.

d. R-F Oscillator. The r-f oscillator circuit uses a parallel-connected dual-triode 6J6 tube V6. The range of the oscillator is 20 to 100 mc which is divided into five bands. Band changing is accomplished through use of a turret switch. Ganged capacitors tune the oscillator for each band. From the r-f oscillator, the signal is fed to a double-piston-type attenuator. In the attenuator, there is a crystal diode which rectifies a portion of the r-f energy for monitoring the input of the attenuator. The 50-ohm coaxial, r-f output cable is terminated in a matching network to prevent standing waves, and also, to change the output impedance to 10 ohms.

e. 1,000-cps Oscillator. A 1,000-cps audio signal is developed by the two 6AH6 pentode tubes, V7 and V8, connected in a Wien bridge oscillator circuit. The Wien bridge circuit is used because its output is a relatively pure sine wave, which is required as an input to reactance modulator tube V5. This stage generates the internal audio signal for frequency modulation of the r-f oscillator.

f. Modulator A-F Output. The modulator a-f output stage receives a signal from either the 1,000-cps oscillator stage or the external audio terminals (EXT MOD). In the stage input circuit, a potentiometer, the DEVIATION LEVEL control adjusts the amount of audio which eventually is used to modulate the r-f oscillator. The cathode-follower output circuit provides a substantially constant output impedance and acts as an ideal source of the a-f for the reactance tube at all voltage levels.

g. Calibration A-F Amplifier Output Stages. The amplitude of the beat-frequency signal which

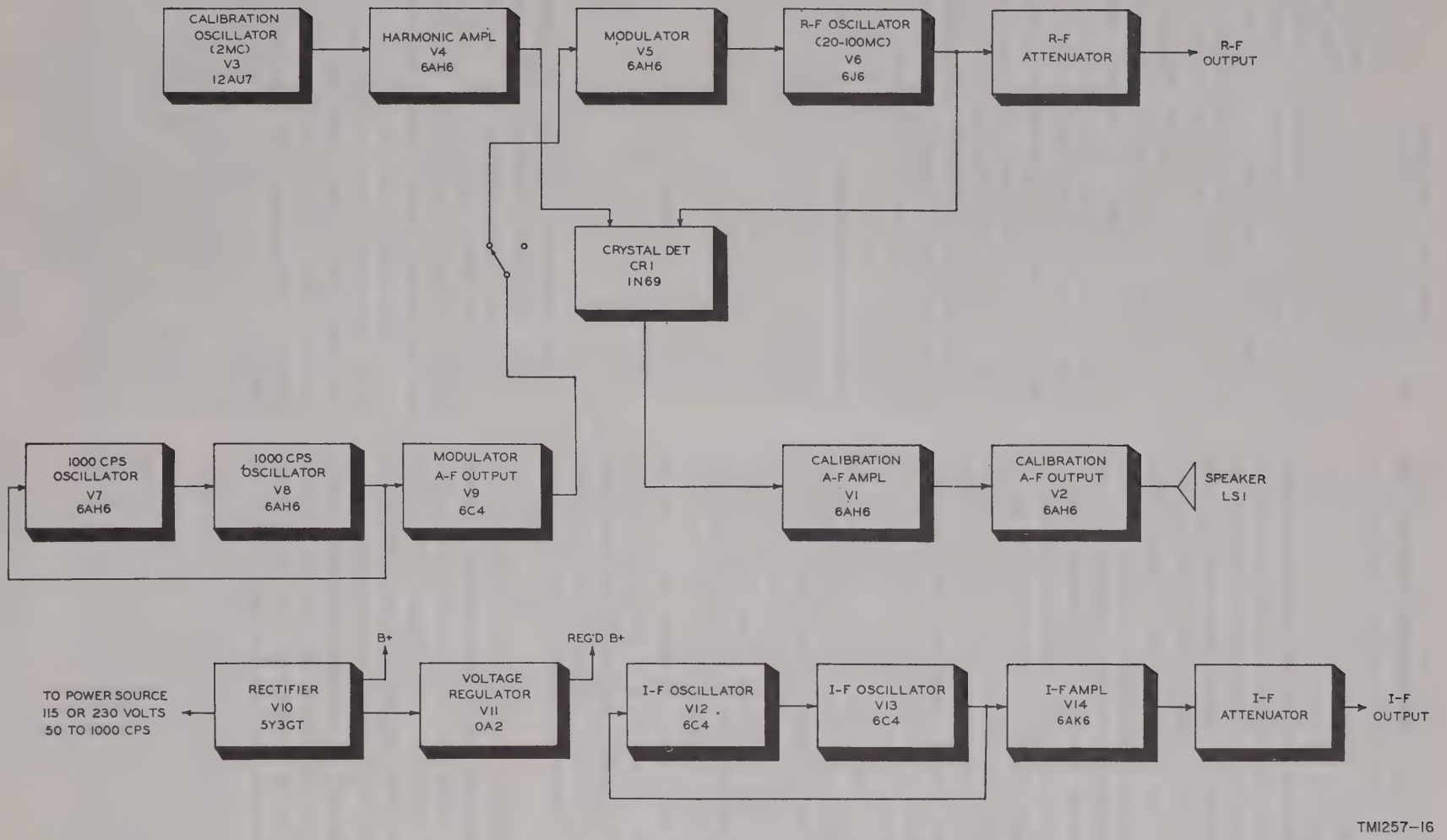

Figure 16. Signal Generator SG–12/U, block diagram.

is taken from the calibration oscillator and the r-f oscillator is small. To allow the detected audio beats to drive the panel speaker, two amplifier stages, V1 and V2, are used.

h. I-F Oscillator. The i-f signals are generated by the cathode-coupled i-f oscillator stage which consists of two 6C4 triode tubes V13 and V14. The oscillator circuit is similar to that of the calibration oscillator stage. In this stage, the tuned circuits and crystals are switched by means of a turret and gang switches. Nine crystal frequencies are available, and provision is made for the addition of two more crystals and their associated tuned circuits. The signal which is developed is fed into i-f amplifier stage V15.

i. I-F Output Amplifier. The tuned i-f output amplifier stage uses a 6AK6 pentode tube. It has a common switch shaft with the i-f oscillator stage and, therefore, has its tuned circuits switched at the same time. The maximum voltage from the i-f output amplifier (V14) is 1 volt. By varying the screen-grid voltage on V14 through R91 (IF LEVEL), the output level is made continuously variable. The continuously variable voltage is divided in factors of 10 by a resistance-type attenuator to provide 20-db steps of any voltage set by the IF LEVEL control and indicated by the I. F. MICROVOLTS meter. The output is taken from the signal generator by a 50-ohm coaxial cable. The output of the cable is terminated by a permanently connected head having an impedance of 50 ohms which, in parallel with 50 ohms in the attenuator, provides a 25-ohm output impedance.

j. Power Supply. The power supply section of the signal generator furnishes both the a-c filament and the B+ supplies. The input to the power supply may be either 115 or 230 volts. The output of the supply is 6.3 volts a-c unregulated for all the tube filaments, except the modulator and r-f oscillator tubes which require a regulated filament supply. The power supply also provides 250 volts unregulated for the noncritical B+ circuits, and 150 volts regulated to stabilize critical B+ circuits. The rectifier is a full-wave 5Y3GT tube (V10), and the regulator is a gaseous OA2 tube (V11). The filtering of the B+ circuit in the power supply is handled by two pi-section filters. An a-c line filter prevents r-f in the signal generator from being radiated across the a-c line. Both sides of the line are fused.

47. Calibration Oscillator

(fig. 17)

a. Calibration oscillator V3 generates a crystal-controlled frequency of 2 mc which is beat against the r-f output frequencies to check dial calibration and to make highly accurate indirect frequency settings. The harmonics of the 2-mc crystal oscillator beat against the *fundamental* r-f oscillator frequencies for the even-marker frequencies and against the *second harmonic* of the r-f frequencies for the odd-marker frequencies. This action provides usable crystal check points spaced at 1-mc intervals up to approximately 60 mc. After this point, the second harmonic of the r-f usually is not strong enough to produce audio beats which can be heard under the noisy conditions. Two mc markers are usable for the remainder of the frequency range. The following table shows examples of the combinations of calibration oscillator and r-f oscillator frequencies which give *zero beats.*

Desired frequency to be tuned (mc)	R-f oscillator frequency (mc)	Calibration oscillator 2-mc harmonic
20	20	10
21	42 (2d harmonic)	21
22	22	11
37	74 (2d harmonic)	37
38	38	19
39	78 (2d harmonic)	39

b. A dual-triode 12AU7 tube is used for the crystal calibration oscillator. The two triode sections are cathode coupled by a 2-mc crystal Y10. The crystal provides the feedback path. Triode section 1, 2, 3 of V3 has its grid grounded, and the feedback voltage from triode section 6, 7, 8 is impressed across cathode-biasing resistor R12. The output of this section appears across the plate (pin 1) load which is made up of a parallel-resonant circuit consisting of inductance coil L1 and capacitor C7. Coil L1 is tunable and may be used to correct the frequency oscillation slightly if crystal Y10 is not exactly oscillating at 2 mc. The plate circuit of section 1, 2, 3 of V3 is fed from the second section of the pi-filter. The B+ supply for the calibration oscillator and the harmonic amplifier is filtered by means of the RC (resistance-capacitance) decoupling filter which consists of capacitors C8 and C63 and resistor

R11. Initially, when there is a surge of current through the first section of V3, a pulse or r-f wave is developed in the plate load tank circuit. This pulse is transferred through capacitor C9 to the grid of the second section and is impressed across grid resistor R17. The plate of the second section (6, 7, and 8) is connected to r-f ground through capacitor C63; thus load resistor R16 is in the cathode circuit. Crystal Y10 is operated as a series-resonant crystal and offers a high impedance to all frequencies except the frequency at which it is resonant. Very little energy is transferred from resistor R16 through crystal Y10 to resistor R12, unless it is at a frequency of 2 mc. The coupling action of this crystal causes the necessary feedback to sustain oscillation. When the feedback voltage is developed across resistor R12, this voltage appears directly across the cathode and grid of the first section because the grid is grounded. The output signal from the oscillator stage is coupled to the following stage by coupling capacitor C10. The calibration oscillator operates only when OPERATION switch S1 is in the CAL position. The plate circuit B+ is fed through the same decoupling chokes and pi-filters as those used for the plate and screen circuit of harmonic amplifier V4.

48. Harmonic Amplifier

(fig. 17)

The r-f output taken from V3 is impressed across grid resistor R18 of V4. From this point, the signal is amplified in such a way as to produce a multitude of harmonics. The harmonic amplifier is a wide-band amplifier which is operated to produce the required harmonics. Bias resistor R19 is bypassed for r-f by capacitor C12. The plate load consists of a 400-ohm wire-wound resistor R21. The wire windings of the resistor produce enough inductance to cause the resistor to act as a low Q choke. Thus the wide-band characteristics of the amplifier are obtained. The B+ path to the harmonic amplifier is from the output end of filter choke L16, through OPERATION switch S1 and the interconnection plugs (J7 and P7), and then through two decoupling networks (Z3 and L35). R-f choke L35 and filter Z3 prevent the r-f generated in the calibration oscillator and amplifier circuits from radiating to the power supply and other circuits in the signal generator. Resistor R20 is the voltage-dropping resistor for the screen-grid circuit of V4. The screen grid is bypassed for r-f by capacitor C13. The output signal of the harmonic amplifier is used to beat against r-f oscillator V6 as an indirect method of

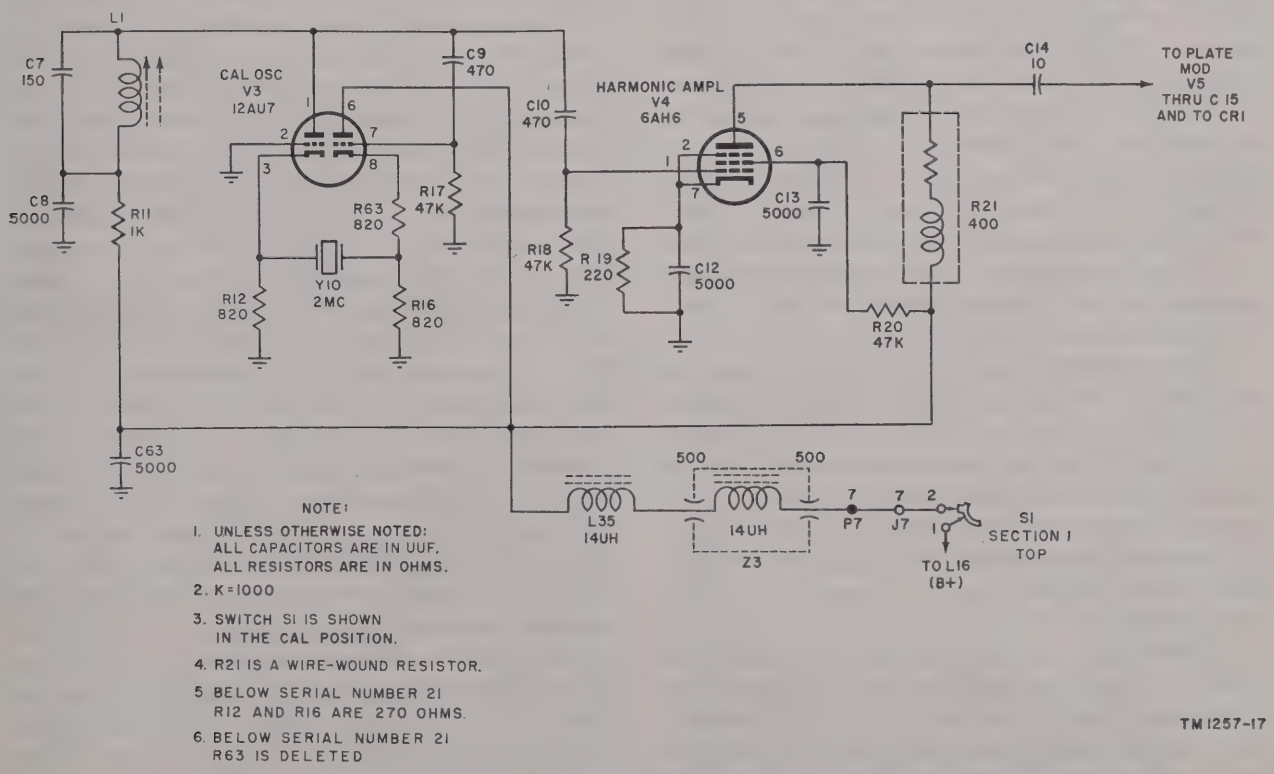

Figure 17. Calibration oscillator and harmonic amplifier, simplified schematic diagram.

setting the r-f output frequency. These two signals are mixed and demodulated at crystal detector CR1. Coupling capacitor C14 is used to feed a small amount of harmonic amplifier output to the crystal diode detector.

49. Reactance Modulator
(fig. 18)

a. Reactance modulator tube V5 changes the output frequency of the r-f oscillator (V6) in accordance with the audio signal applied to its control grid. The amplitude of the modulating audio signal applied to V5 determines the amount of deviation from the r-f oscillator center frequency, and the frequency of the audio signal determines the rate of the deviation. Tube V5 acts as an electronic capacitance and shunts the tuned circuit of the r-f oscillator. Any change in the value of the effective capacitance changes the frequency of the oscillator. An audio signal impressed on the grid of V5 changes this effective capacitance at an audio rate; consequently, the r-f oscillator frequency is varied at the same rate.

b. Resistor R28 and capacitor C18 form a phase-shifting network through which r-f voltage is coupled from the plate of the r-f oscillator to the grid of V5. The r-f voltage applied is shifted approximately 90° through R28 and C18. The plate current of V5 is in phase with its grid voltage. Thus, plate current is 90° out of phase with and leading the plate voltage. Under these conditions, V5 appears as a capacitance across the r-f oscillator tank, since the current across a capacitor leads the voltage by 90°, as the plate current of V5 leads its plate voltage by 90°. When the magnitude of the effective capacitance of V5 is varied about some mean point, the frequency of the r-f oscillator will be varied about some center frequency.

c. The effective capacitance of V5 must be variable in accordance with the audio signal applied to its grid. During modulation, the grid of reactance tube V5 is swung about its normal operating point by the audio signal. The audio signal variations on the grid cause corresponding variations in the reactive plate current, in the effective capacitance across the oscillator tank, and in the oscillator frequency.

d. Capacitor C18 and resistor R28 form the previously mentioned phase-shifting network. For r-f signals, R28 is grounded effectively through C19. Audio signals fed to the grid of V5 through resistors R27 and R28 are not bypassed by C19 because of its high reactance to a-f signals. R-f is prevented from flowing to other circuits by r-f choke L4 and r-f filter Z5. The r-f oscillator range is 20–102 mc; therefore, compensation must be made for deviation variations with oscillator frequency. To correct this variation on different bands of the r-f oscillator, a different resistor is inserted in place of resistor R28 on each of the five bands. The action of the resistors is similar, but their values are changed to produce constant frequency deviation. Other factors are involved in changing the r-f oscillator frequencies. Two of the most important factors are the capacity between the leads running from the turret contacts to the phase-shifting resistor, and the inductance of those leads. In figures 48 and 49, the entire section of the turret shows all five resistors, R28 through R32. For the two low bands, A and B, added inductance is necessary across the resistor to compensate for the capacity between the lead wires. In the two middle bands, C and D, the capacitive reactance equals the inductive reactance and, therefore, no extra inductance or capacitance is necessary. In the highest band (E), capacity across resistor R32 is necessary to tune out the lead inductance.

e. Modulator tube V5 must be operated within the straight portion of its characteristic curve, so that the frequency deviation above and below the center frequency will be equal. That portion of the curve is determined by the plate and screen voltages and the amount of bias which is applied. Sometimes it is desirable to vary these voltages because of the difference in characteristics of modulator tubes. A variable grid bias is provided for this purpose. The bias is obtained by resistor R26 which is bypassed by capacitor C17. Resistor R26 is also a part of a voltage-divider network which consists of resistors R23, R24, R25, and R26. Potentiometer R23 is connected as a rheostat and varies the amount of current in the voltage divider. Changing this current also changes the voltage appearing across resistor R26 which in turn appears as a change in grid bias on the modulator tube. The a-f voltage applied to the control grid is filtered for r-f by R27, C19, L4, and Z5. When no modulation is being used, the control grid is returned to ground. The plate of V5 receives its voltage from the same source as r-f oscillator V6 in that its plate is connected directly to the oscillator plate. The screen-grid dropping resistor is R22. The screen grid is bypassed to the cathode by capacitor C16. The

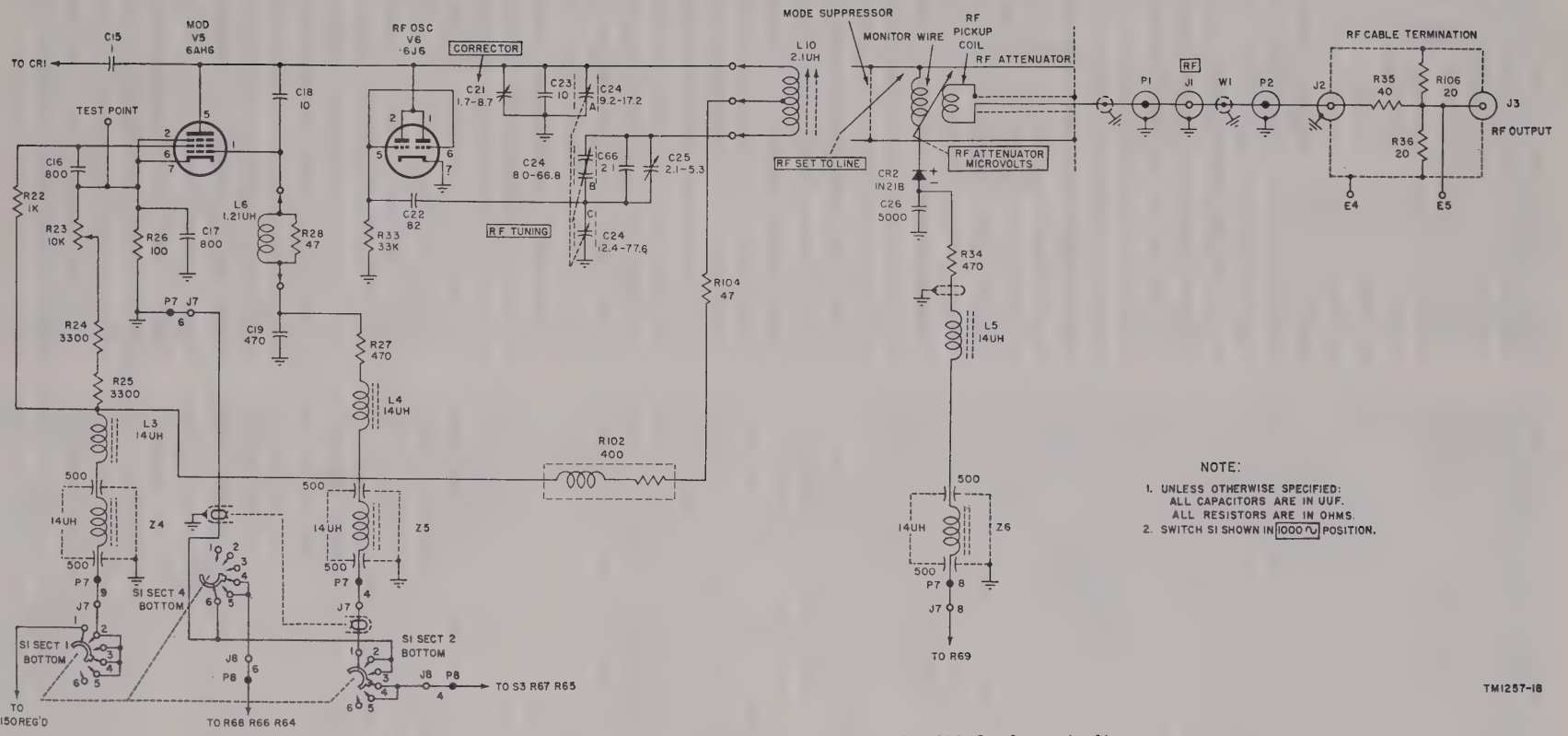

Figure 18. Modulator and r-f oscillator stages, simplified schematic diagram.

screen-grid and plate voltages for V5 and V6 are filtered by r-f choke L3 and filter Z4 before they leave the r-f assembly housing. This prevents any r-f leakage from the assembly. The plate and screen voltages are regulated to reduce the tendency towards drift.

f. In the equipments after serial number 110, a hum balancing circuit is used in conjunction with the modulator tube to maintain a high signal-to-noise ratio. Capacitors C67A and C67B place both sides of the modulator filament leads at the same potential with respect to the chassis. This reduces the maximum Emf (electromotive force) between the modulator filament and cathode to one-half of the filament voltage (3.15 volts). The filament midpoint is then at approximately the chassis potential. With this condition, leakage currents between filament and cathode are located symmetrically with respect to the zero potential point (center) of the filament and will tend to cancel. This is due to the currents being 180° out of phase. Sometimes there are residual leakage currents due to a symmetrical location of the leakage paths about the zero potential point. Compensation is provided by the proper setting of potentiometer R107 which provides current of the proper magnitude and phase to cancel the residual leakage current. This bucking current is supplied through resistor R108 to the cathode of V5. Resistor R108 causes a limiting action on the magnitude of the compensating current and provides noncritical adjustment of potentiometer R107. The revised r-f oscillator and modulator circuit is shown in figure 19.

50. R-f Oscillator

(figs. 18 and 19)

a. The 20- to 100-mc portion of the signal generator output is generated by r-f oscillator stage V6. This stage uses a parallel-connected dual-triode 6J6 tube. A simplified diagram of the oscillator is shown in figure 18. Oscillation frequency is determined by the tunable plate circuit. A five-band turret switches in the correct coil for the frequency range to be covered. The complete turret is made up of both the oscillator tank coils and the resistance portion of the modulator phase-shifting network.

b. Five spring-type contacts are used to make the turret connections to the modulator and oscillator circuits. In addition to making electrical connections, the turret mechanically positions the proper oscillator tank coil so that it is coupled mutually to the pickup coil in the r-f attenuator. For the purpose of discussion, the turret will be considered to be in the band A position.

c. The tuning of the r-f oscillator is accomplished by a gang capacitor consisting of C24A, C24B, and C24C. Mechanically, the ganged tuning capacitor is coupled to a dial on the front panel and also to a vernier dial which is called the RF TUNING control. The tuning dial has five scales, each corresponding to an r-f range. Since the scale divisions are linear, the combined use of the dial scales and the vernier scale permits extremely accurate frequency setting.

d. R33 is the grid leak resistor, and C22 is the grid leak capacitor. Capacitor C24C maintains a constant feedback voltage into V6 while the network of capacitors C24B, C66, and C25 determine the oscillator frequency. The network of capacitors C21, C23, and C24A maintains a constant frequency deviation when the oscillator frequency is modulated. Capacitor C25 trims the oscillator coil and, therefore, is used to adjust the high end tracking for all bands. Actually this is only done at 39 mc, and it holds the tracking close enough on the other bands to permit the use of one adjustment. Capacitors C23 and C66 are temperature compensating capacitors. The low ends of each band are set by adjustment of the tank coil inductance. In manufacture, these adjustments are cemented and cannot be changed in the field unless the original coils are replaced by coils with loose cores. CORRECTOR control capacitor C21 is connected in parallel with C24A. When this control is set to the line, the dial calibration of the r-f oscillator is within .5 percent. When the internal crystal calibrator is used, the dial is set to the exact frequency and then C21 slightly changes the r-f oscillator frequency to correspond to that frequency. If C21 is left in a corrected position, the dial is accurate to better than .03 percent between the next two crystal markers.

e. The regulated plate voltage for the stage is filtered by r-f choke L3, resistor R102, and filter Z4. Resistor R102 is a 400-ohm, wire-wound type used as an r-f choke, because it displays the properties of inductance in addition to resistance. Parasitic oscillations are suppressed by the use of R104. No bypass capacitors are necessary at the junction of R104 and at the oscillator coil because of the bypassing action of the stray lead capacity.

f. The oscillator may be modulated or unmodulated. This is determined by OPERATION switch S1. In the 1000 ~ and EXT MOD

positions, the modulator receives audio signals and modulates the oscillator. In the MOD OFF position, the audio signal is not supplied to the reactance modulator and no frequency modulation is obtained.

51. R-F Attenuator

(figs. 18 and 19)

a. The r-f attenuator input is placed close to the operating r-f oscillator coil. By mutual inductance, the r-f energy is transferred from the oscillator coil through a mode suppressor past a monitor wire to the attenuator r-f pickup coil. The r-f pickup coil is connected to a 50-ohm coaxial cable which leads to the front panel and is connected to jack J1. From jack J1, which is permanently connected on the front panel, the signal is fed to a length of 50-ohm coaxial cable which is used to supply the output voltage to the unit under test. A small metal box (W1), which contains a resistor network consisting of resistors R35, R36, and R106 is attached permanently to the end of this external cable. The total impedance of resistors R35, R36, and R106 from the generator end is 50 ohms. This terminates the cable in the proper impedance and prevents standing waves on the line. The output signal is taken off across parallel resistors R36 and R106 which have a total value of 10 ohms. By using this arrangement, the generator has the effect of presenting a very low impedance, thereby minimizing the loading caused by low-impedance receiver under test. The loading effects of such a receiver should be taken into account in the output voltage calibration of the generator. Refer to paragraph 20 for loading characteristics.

b. Physically, the attenuator is made up of three basic parts: the housing, the outer piston, and the inner piston. Refer to figure 20 for a cross-sectional view of the attenuator. The attenuator housing is attached permanently to the wall of the r-f assembly, and its position remains fixed. The outer attenuator piston is arranged so that it will slide in and out of the attenuator housing when the RF SET TO LINE control is moved. It carries the monitor wire and the inner piston along with it in its travel. Therefore, each time the outer piston moves, the inner piston moves the same distance and in the same direction. The outer piston sets the r-f level to keep the correct amount of signal at the r-f pickup coil, so that the attenuator calibration is always correct. The monitor wire extends across the attenuator opening and is attached physically to the outer attenuator, so that it is possible to check that the correct level is being sent to the r-f pickup coil. The indication of this level is obtained by rectifying the voltage developed across the monitor wire with a crystal diode CR2 in a series circuit with 30-microampere meter M1 (fig. 28). The inner piston moves the r-f pickup coil to deliver the output signal. This piston is coupled to the RF ATTENUATOR MICROVOLTS knob which is calibrated from .05 to 10,000 uv. By moving the pickup coil closer to the oscillator coil, more output is developed. When the distance between the two coils is increased, there is less mutual induction which causes a lower r-f output signal. When the output of the r-f oscillator coil enters the mouth of the attenuator, there are unwanted electrical fields set up which could cause errors due to capacitive coupling between the two coils. The errors are reduced greatly by using an electrostatic shield, which is called a mode suppressor, at the mouth of the attenuator. In figures 18 and 19, this shield is shown as a dotted line. Refer to figure 20 for a cross section view of the r-f attenuator.

52. 1,000-cps Oscillator

(fig. 21)

a. A Wien bridge oscillator circuit is used to supply the necessary audio signal for internal modulation of the signal generator. Figure 21 shows a simplified schematic diagram of the oscillator. Two 6AH6 pentode-type tubes, V7 and V8, are used in the circuit.

b. The two-tube circuit resembles a two-stage amplifier with feedback from the plate of the second stage being fed to the grid of the first. The feedback is coupled from the plate of V8 through capacitor C30. From capacitor C30, it takes two paths to V7. Positive feedback travels through resistor R38 and capacitor C27, and that portion of the signal appearing across R39 and C28 is fed to the grid (1) of V7. The negative or degenerative feedback path is from capacitor C30 through resistors R42 and R43 to the cathode (7) of V7. The bridge consists of resistor R38 and capacitor C27 in the first leg, resistors R42 and R43 in the second leg, resistor R40 in the third leg, and capacitor C28 and resistor R39 in the fourth leg. The bridge is fed at the junction of resistors R38 and R42. The values of the bridge components are such that a positive feedback voltage will appear at the grid of V7 only at a frequency of 1,000 cps. At all other frequencies, the degeneration introduced will

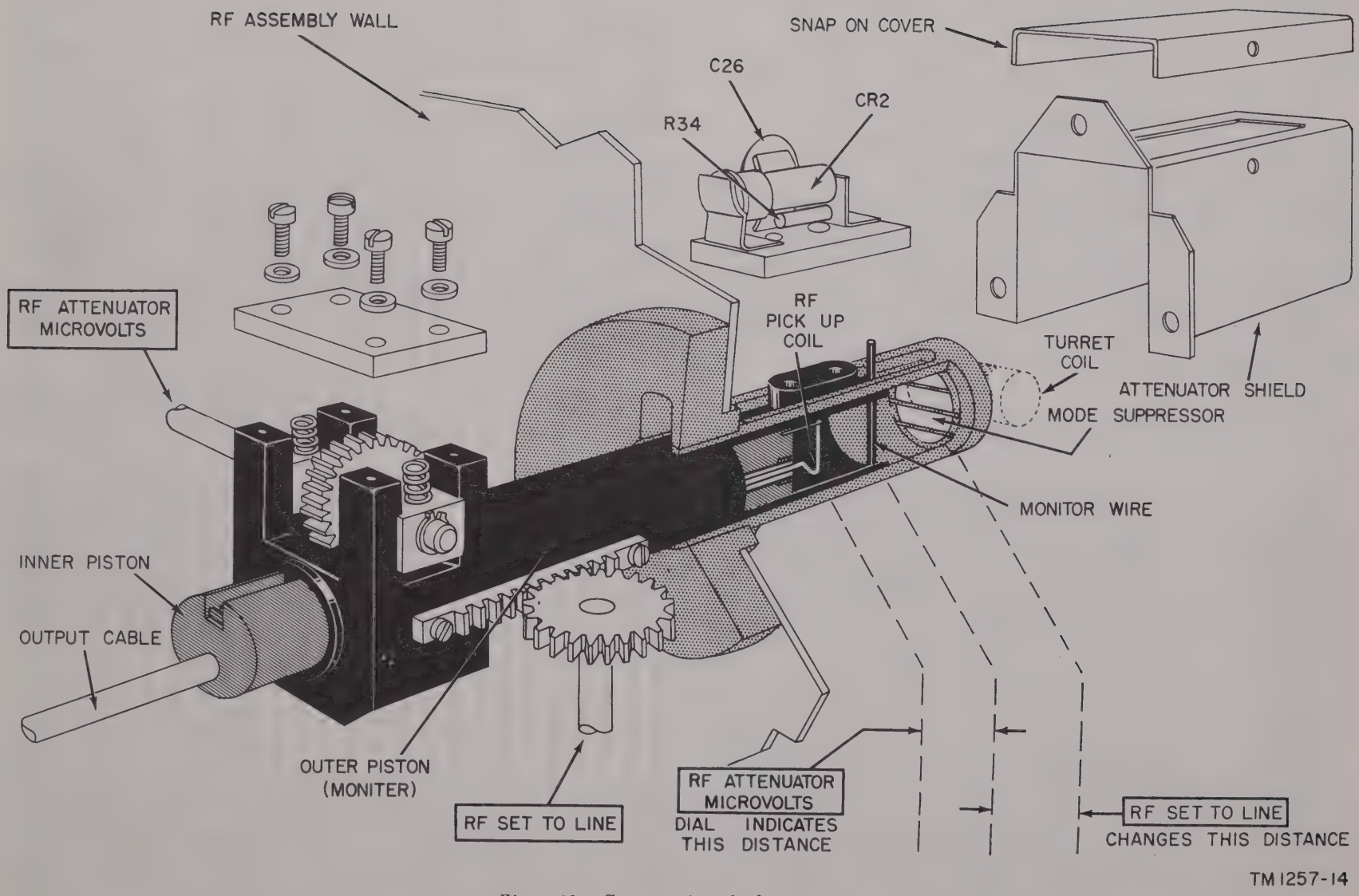

Figure 20. Cutaway view of r-f attenuator.

not allow oscillation. The degeneration voltage is adjusted by means of R43. The adjustment also varies the percentage of distortion in the oscillator circuit.

c. The plate load of V7 is resistor R41. Voltage that is developed across R41 is fed to V8 through capacitor C29. The grid-return resistor of V8 is R44. Tube V8 has 3-watt lamp I 3 in series with cathode-biasing resistor R45. The action of this lamp stabilizes the output amplitude of V8. If the output signal of V8 increases, more current is drawn through the tube and lamp I 3. As the current through lamp I 3 increases, its filament temperature increases; this increases the filament resistance. There is, therefore, a greater voltage drop across the lamp which has the effect of limiting the current through V8.

d. Output to the modulator a-f output stage V9 is developed across R47, the plate load resistor of V8. Capacitor C32 is the coupling capacitor to stage V9. Section 2 of OPERATION switch S1 applies plate and screen-grid voltage to V7 and V8 only in the 1000 ~ position. The plate circuit is bypassed for audio frequencies by filter capacitor C6B. The screen grids have a decoupling filter, in the B+ circuit, which consists of resistor R46 and capacitor C31.

53. Modulator A-F Output
(fig. 22)

a. The modulator a-f stage receives audio signals from either the internal 1,000-cps oscillator or from an external source. When the external source is used, the signal is applied to EXT MOD terminals E1 and E2. This input is shunted by 600-ohm resistor R37 to match the audio oscillator output impedance. From R37, the external signal passes through r-f filter Z7 to section 4 of OPERATION switch S1. For external modulation, the switch is placed in the EXT MOD position and for internal modulation the switch is placed in the 1000 ~ position.

b. After the signal to be used is selected, it passes from switch S1 to DEVIATION LEVEL control R49. This control is used to adjust the amount of signal which is supplied to the grid of V9, the modulator a-f output tube. Since the output of V9 is used to supply a signal to the grid

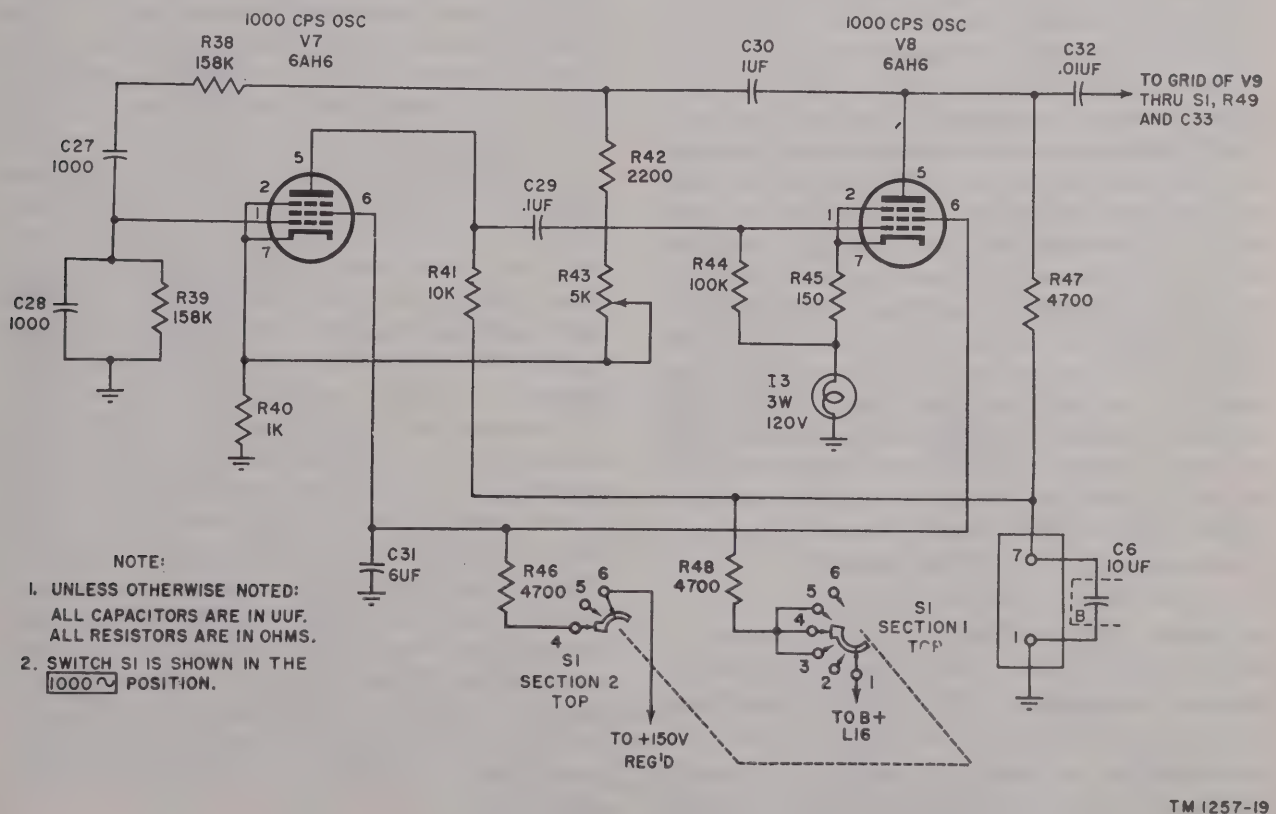

Figure 21. 1000-cps oscillator, simplified schematic diagram.

of reactance tube V5, R49 is the front panel control which sets the deviation level of the r-f oscillator.

c. Tube V9, a 6C4 triode, is connected as a cathode-follower to prevent loading of the 1,000-cps oscillator by the metering circuit. The grid coupling capacitor is C33 and the grid resistor is R50. Bias is developed across cathode resistor R51. The total resistance of resistors R51 and R52 is used as the cathode follower output load. Resistor R100 in the plate circuit limits the tube current. No audio voltage is developed across R100 because the plate is bypassed for a-f by capacitor C6C.

d. The output is taken from the cathode through capacitor C34 which is connected to the junction of resistors R56 and R57. This connection feeds the audio signal to a metering circuit and to an attenuator circuit. The bridge metering circuit consists of meter M2, crystal diode rectifiers CR4 and CR5, current limiting resistor R55, and two bridge resistors R53 and R54. The a-m level, which is set by R49, is indicated on the KILOCYCLES DEVIATION meter M2. The signal then is fed through compensating resistors (*e* below) selected by BAND SWITCH S2 to the DEVIATION RANGE attenuator. The DEVIATION RANGE attenuator consists of resistors R64, R65, R66, R67, and R68. Attenuator switch S3 has three steps. The first step (100) does not attenuate the modulation signal; it passes the full level set by the DEVIATION LEVEL and produces a maximum deviation of 100 kilocycles. The second step (50) attenuates the signal by one-half which produces a frequency deviation of 50 kilocycles of the r-f oscillator if the DEVIATION LEVEL is set to make the KILOCYCLES DEVIATION meter read full scale. The third step (25) has one-fourth the output of the first range and produces 25-kilocycle deviation for a full-scale reading on meter M2. The reading of meter M2 does not change for different settings of the DEVIATION RANGE switch, since it measures the input to the attenuator.

e. Meter M2 is calibrated by means of potentiometer R57. Each r-f band requires a different level of modulating signal for comparable frequency deviations. Adjustments for each band are made by potentiometers R58 through R62, corresponding to bands A through E. Resistor R56 is part of the voltage divider and is common to all bands. Switch S2 is used to select the proper dropping resistor and is ganged to the r-f turret by means of a chain drive.

54. Calibration A-F Amplifier and Output Stage

(fig. 23)

The crystal marker frequencies are beat against the r-f, oscillator-tuned frequencies (par. 49). These beats are used to indicate when the r-f oscillator is set correctly to a desired crystal check point. Capacitors C14 and C15 couple the output signals from V4 and V6. These mixed frequencies are demodulated by crystal diode detector CR1. The diode is a shunt-type detector that uses resistors R14 and R15 as a load. Capacitor C11 bypasses any r-f which may have leaked past the detector and may appear across resistor R14. The output of the detector passes through RC (resistance-capacitance) filter consisting of resistor R13 and filter Z1. From the filter, the signal is coupled to the calibration a-f amplifier stage V1 through coupling capacitor C1. The signal is impressed on the control grid of tube V1. R1 is the grid-return resistor. Bias for the first stage is developed across cathode-biasing resistor R2 bypassed by C4. The circuit is a conventional voltage amplifier. The plate load resistor is R4. The screen-grid dropping resistor is R3 and is bypassed by capacitor C2A. The amplifier signal from V1 is coupled to the grid of V2 through coupling capacitor C3. R5 is the grid-return resistor. Calibration a-f output stage V2 is connected in the same manner as V1; however, the output load consists of transformer T1 which matches the voice coil impedance to the plate load and supplies maximum power audio signal to front panel speaker LS1. Self-bias in the cathode circuit is developed across resistor R7. The screen-grid dropping resistor is R8. The screen-grid bypass is the second section of C2 which is C2B. The plate and screen-grid circuits of both amplifier tubes use a common decoupling filter, which consists of resistor R6 and capacitor C6A. Capacitor C5 is connected from the plate of V2 to ground to reduce the amplitude of the higher frequencies of the beat note. For the same purpose, resistor R9 acting as a voltage divider, is placed in series with the primary of transformer T1. The two calibration a-f amplifier stages operate only in the CAL position of OPERATION switch S1.

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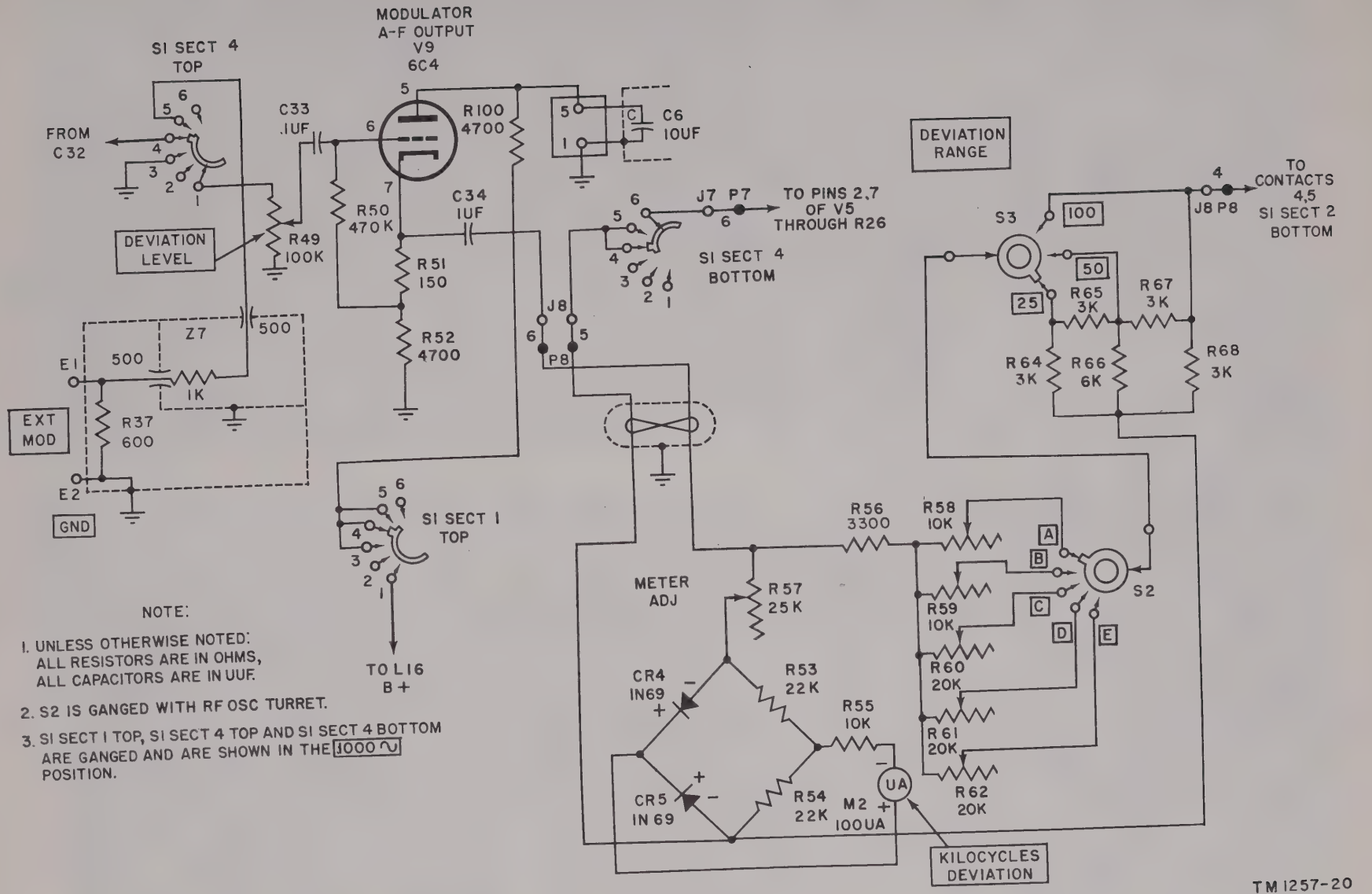

Figure 22. Modulator audio-output stage, simplified schematic diagram.

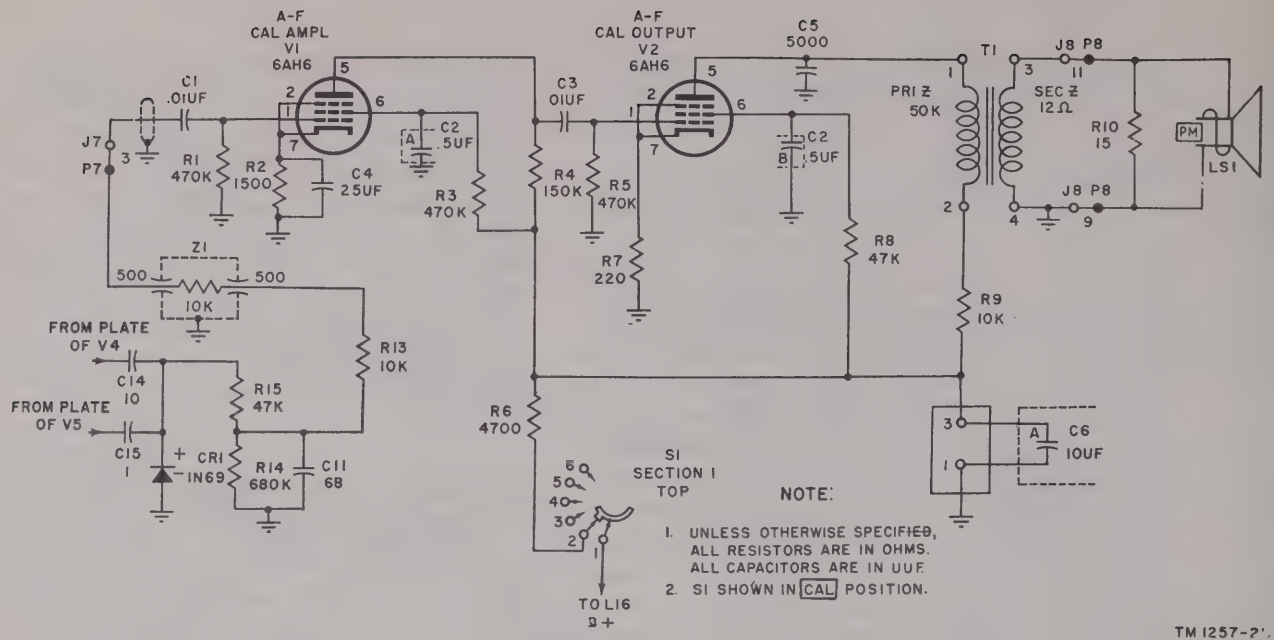

Figure 23. Calibration amplifier stages, simplified schematic diagram.

55. I-F Oscillator

(fig. 25)

The i-f oscillator consists of a two-tube, cathode-coupled crystal oscillator circuit, similar to the calibration oscillator circuit, and uses two triode-type 6C4 tubes (V12 and V13). Figure 25 shows a simplified schematic diagram of the i-f oscillator stages; however, it shows one crystal and one tuned circuit. There are nine frequencies available in the unit, but for the explanation of the circuit, all positions of the switch are considered to operate in the same manner. Any crystals in the 1- to 20-mc range can be used in the spare turret spaces. Installation of crystals in the spare positions is described in *c* below.

a. Tube V12 is connected with the grid grounded and with a tuned circuit for the plate load. In the diagram (fig. 25), the tuned circuit in the plate consists of coil L18 and capacitor C40. This stage is coupled to the following stage V13 by capacitor C48. Tube V13 uses a cathode-follower circuit. Resistor R101 is a current limiting resistor in the B+ circuit. The plate of V13 is bypassed directly to ground for r-f by capacitor C65. Whenever a signal is impressed across grid resistor R95, a signal of the same polarity appears across cathode resistor R94. With the two cathodes coupled by means of a series-resonant crystal, feedback can be supplied to the first stage where it will appear across cathode resistor R93. Feedback can occur only at the resonant frequency of the crystal, because at that frequency the crystal impedance is very low; therefore, the coupling is high. At any other frequency, the crystal will act as a high impedance and will not transmit the feedback voltage. Since the grid of the first stage is grounded, the feedback voltage appears 180° out of phase between the cathode and grid to sustain oscillations. Both plate circuits of tubes V12 and V13 have separate decoupling networks. Capacitor C38 and resistor R92 filter r-f for V12 and capacitor C65, and resistor R101 filters r-f for V13. The tubes are fed from a common regulated B+ supply. To prevent i-f signals from leaking through the B+ circuits, a cartridge-type L-C (inductance-capacitance) pi-filter (Z10) is used at the assembly wall. The B+ voltage is obtained from voltage regulator V11 which helps to stabilize the oscillator circuit. The i-f oscillator circuit operates only when OPERATION switch S1 is in the IF position.

b. The switching circuit for the oscillator and amplifier sections consists of switch S8 and the turret which contains the nine crystals, Y1 through Y9. Physically, switch S8 is connected in such a manner that when a tuned circuit is chosen, the other tuned circuits are shorted (fig. 31). The front panel control which turns the turret and switch is designated, IF FREQUENCY MC.

c. The frequency switching arrangement in the i-f oscillator and amplifier circuits has two spare positions. These positions are included to provide two additional i-f circuits if required. To make use of these spare positions, it is necessary to insert the proper crystals in the turret holders, exchange the empty coil forms for wound coils, shunt the coils with the proper capacitance, and wire the tuned circuits into the switching arrangement. All the i-f oscillator and amplifier coils use the same coil form. The four empty coil forms (spare) are mounted in usable positions on the front and rear panels of the i-f oscillator assembly. These coil forms are to be removed and wound with the required number of turns as indicated in figure 24. All the curves are plotted against frequency; therefore, if the frequency is known, the inductance, number of turns, and shunt capacitance can be read from the curves. Below 15 mc, the coils must be wound with a universal-type winding to obtain enough inductance because of the space consideration on the coil form. At or above 15 mc, single layer-type windings are used. The universal-type windings use No. 7–44 Litz wire and a drive and cam gear ratio of 57 to 60. A .125-inch cam must be used. The layer wind-

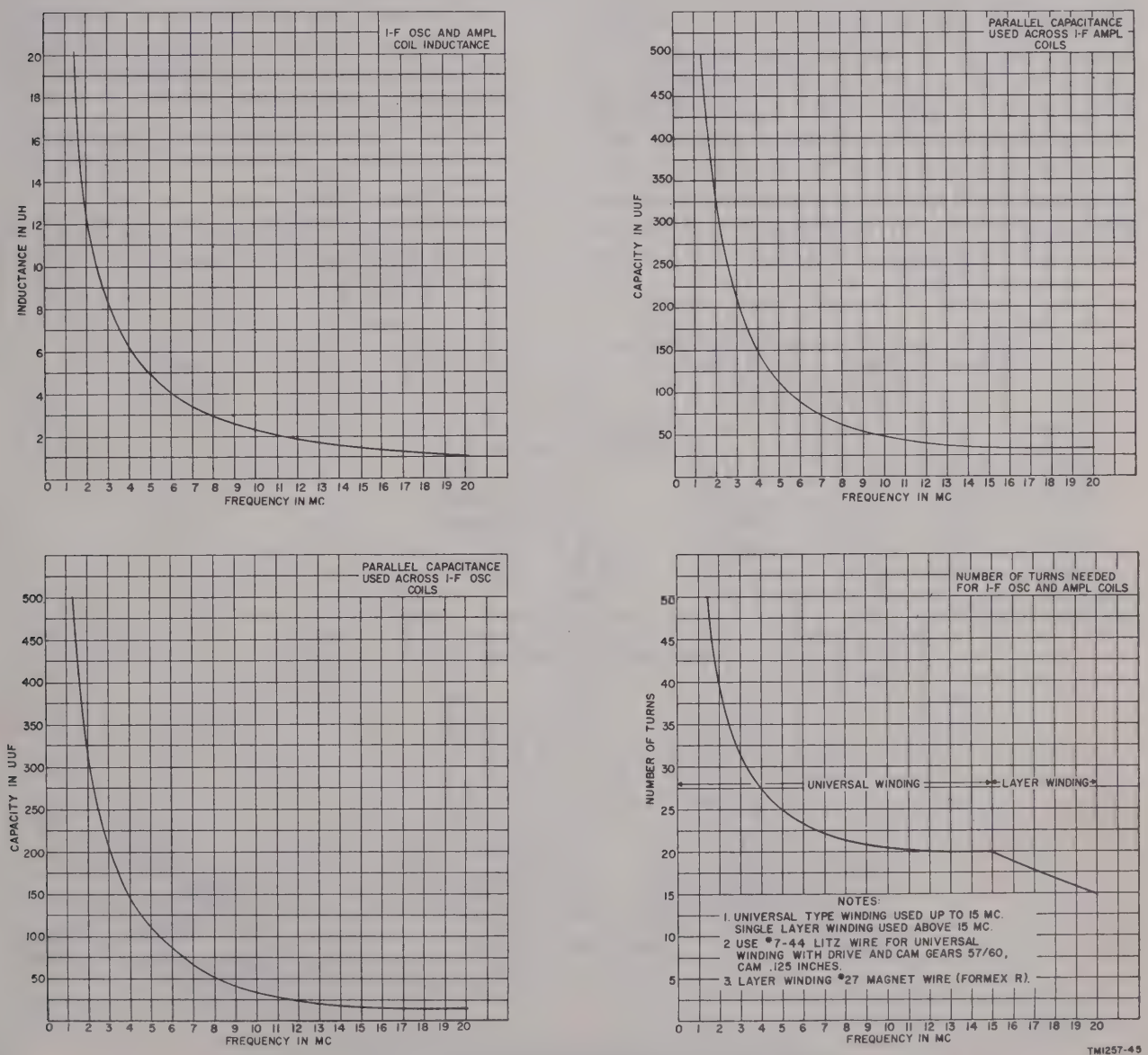
I-F OSC AND AMPL COIL INDUCTANCE
INDUCTANCE IN UH
FREQUENCY IN MC
PARALLEL CAPACITANCE USED ACROSS I-F AMPL COILS
CAPACITY IN UUF
FREQUENCY IN MC
PARALLEL CAPACITANCE USED ACROSS I-F OSC COILS
CAPACITY IN UUF
FREQUENCY IN MC
NUMBER OF TURNS NEEDED FOR I-F OSC AND AMPL COILS
NUMBER OF TURNS
UNIVERSAL WINDING
LAYER WINDING
NOTES:
1. UNIVERSAL TYPE WINDING USED UP TO 15 MC. SINGLE LAYER WINDING USED ABOVE 15 MC.
2 USE #7-44 LITZ WIRE FOR UNIVERSAL WINDING WITH DRIVE AND CAM GEARS 57/60, CAM .125 INCHES.
3. LAYER WINDING #27 MAGNET WIRE (FORMEX R).
FREQUENCY IN MC
TM1257-45

Figure 24. I-f tuned circuit values plotted against frequency.

ings are close wound with No. 27 magnet wire (Formex R). If the spare coil forms cannot be used, refer to the identification table of parts (app. II) for a description of the proper coil forms to be requisitioned. The inductance curve is included for use when the proper wire cannot be obtained; this makes it possible to wind a coil to fit the need. The shunt capacitors to be connected across the coils also are found by use of the curves in figure 24. These curves show the actual values of capacitance, taking stray and tube capacities into consideration. At the lower frequencies, the capacitors for the oscillator and amplifier coils are the same; however, above approximately 4 mc, the amplifier requires slightly more shunt capacity than the oscillator. The switches already are wired to the oscillator and amplifier circuits, but the tuned circuits must be wired to the switches. Follow the same typical placement of parts used for the factory wired coils and refer to figures 48 and 49 for circuit connections. The additional tuned circuits are wired in the same manner as the factory wired circuits. After the assembly of the coils, capacitors, and other disturbed assemblies, aline the i-f circuits as described in paragraph 86. The following example illustrates the use of the graphs for determining the inductance and number of turns for the coils and also the shunt capacitor to be used with these coils.

Example: An intermediate frequency of 18.6 mc is desired.

(1) The intersection of 18.6 mc on the inductance curve is at approximately 1.2 μh (microhenry).

(2) The intersection of 18.6 mc on the number of turns curve is at 16 turns. The wire to be used is No. 27 magnet wire (Formex R), and the coil is to be layer wound. Two identical coils are necessary; one for the i-f amplifier and one for the i-f oscillator.

(3) The shunt capacitor for the amplifier coil is approximately 30$\mu\mu$f (micromicrofarad).

(4) The shunt capacitor for the oscillator coil is approximately 15 $\mu\mu$f.

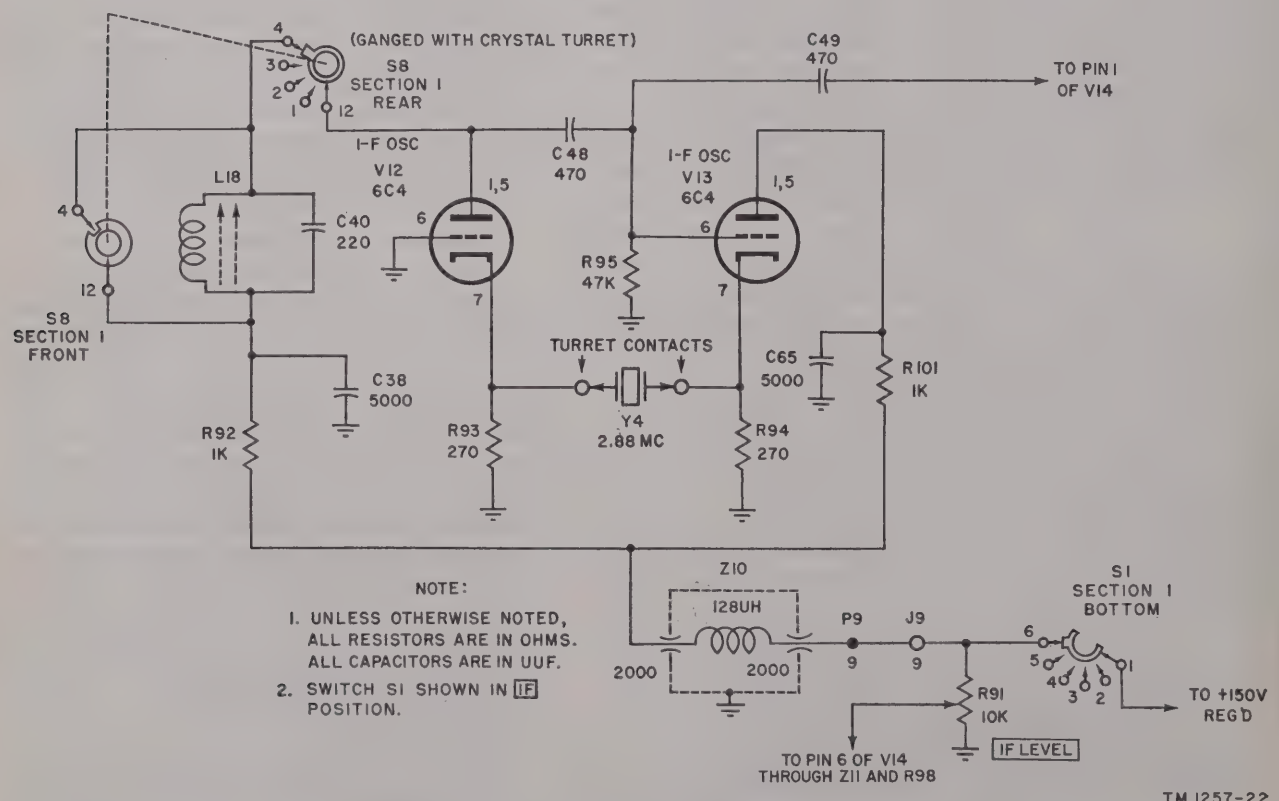

Figure 25. I-f oscillator stages, simplified schematic.

56. I-F Output Stage

(fig. 26)

The signal generated by the i-f oscillator stages is coupled through capacitor C49 to i-f amplifier stage V14. This stage uses a 6AK6 power-amplifier tube. The amplifier is conventional and uses a tuned plate tank circuit.

a. R96 is the grid-return resistor. Self-bias is obtained by series-connected cathode resistors R97 and R105. R105 is not bypassed so that the input capacitance of V14 may be made independent of the mutual conductance of the tube. The mutual conductance is varied by changing the screen voltage to control the stage gain. Variation of the input capacitance, dependent on mutual conductance, must be avoided to prevent detuning of the preceding stage.

b. The plate circuit contains nine resonant tank circuits which are switched by switch S8; however, since they all operate in the same manner, only one tuned circuit (L27 and C55) is shown. The plate tank circuits for the i-f amplifier are changed with the i-f oscillator frequencies. Coupling to the output coaxial cable is accomplished by capacitor C53. Coaxial cable W2 is a short piece of cable which runs from the i-f amplifier output, jack J5, to the input of the i-f attenuator.

c. A decoupling network for the plate circuit is composed of resistor R99, capacitor C52, and filter Z13. Output signals which are fed to the i-f attenuator must have a variable level which can be controlled. The control used in this amplifier is potentiometer R91 (IF LEVEL) which controls the amount of voltage applied to the screen grid. The voltage may be varied between 0 to 150 volts, regulated. The decoupling for the screen grid is furnished by capacitor C51, resistor R98, and filter Z11. Section 1 of S1, the OPERATION switch, allows B+ voltage to be supplied to the plate circuit of V14 only in the IF position.

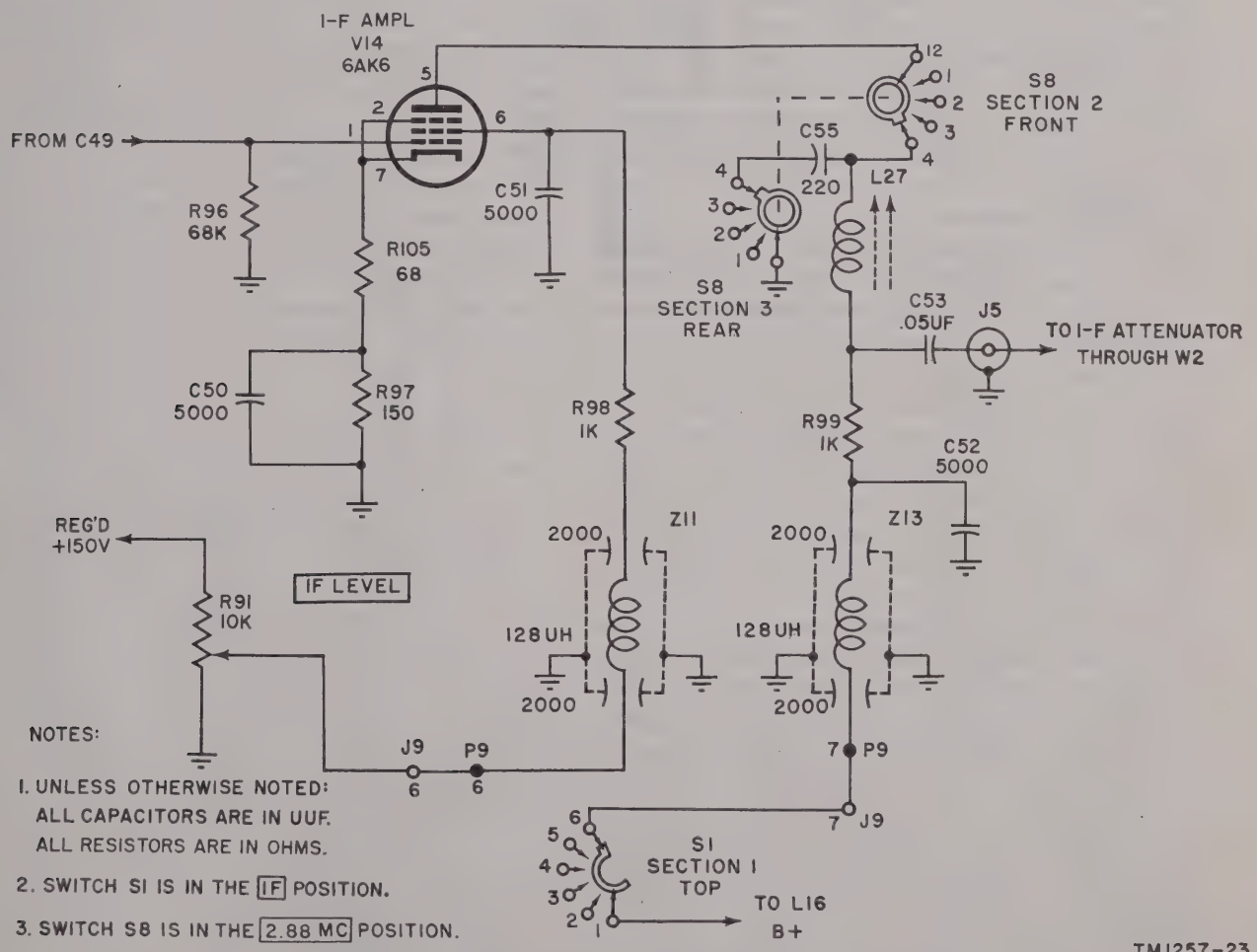

Figure 26. I-f amplifier output stage, simplified schematic diagram.

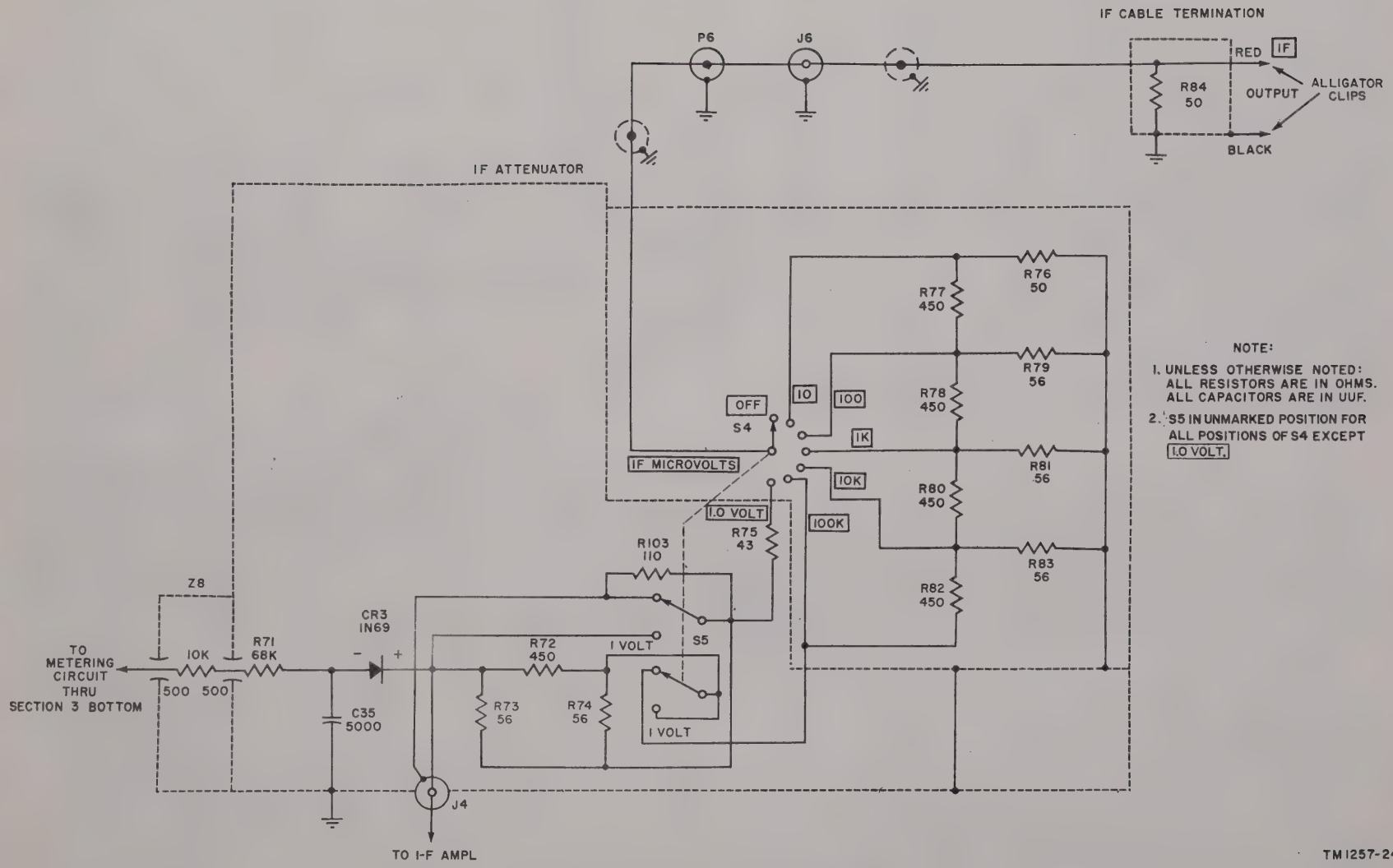

Figure 27. I-f attenuator simplified schematic.

crystal diode CR2 for rectification; C26, R34, L5, and Z6 for filtering; and R69 for meter calibration. The r-f metering circuit operates in all positions of the OPERATION switch except B+ OFF and IF.

59. Power Supply

The power supply provides d-c plate voltages and a-c heater voltage to all the circuits previously described. The simplified circuit is shown in figures 29 and 30.

a. Connection from the signal generator to the power source is made by means of a 6-foot, heavy-duty, rubber-covered power cord which is fastened permanently to the front panel. From the power cord, the line power passes through fuses F1 and F2 and through r-f line filter Z14. This line filter is shielded and consists of a pi-filter section for each side of the line. The values of the filter components are chosen to prevent r-f radiation of a frequency generated by the signal generator. From Z14, the power passes through a double-pole, double-throw line switch which is marked POWER ON-OFF (S6). From the power switch, the a-c line voltage passes to selector switch S7 which permits the two primary windings of transformer T2 to be connected either in series or in parallel. When the windings are in series, the signal generator may be operated from a 230-volt source. By placing switch S7 in the 115-volt position, the signal generator operates from a 115-volt source and the windings are in parallel. For either voltage, the frequency must be between 50 and 1,000 cps. A pair of internal heater resistors, R85 and R86, also are connected to the power line circuit of the signal generator. When switch S6 is placed in the OFF position, the a-c line input is shifted from the transformer primaries to the heater resistor circuit. A section of switch S7 connects the resistors in parallel for 115-volt operation, or in series for 230-volt operation, at the same time that the primary windings of transformer T2 are connected properly for the same voltage. Neon bulb indicator I 6, marked HEATER ON on the front panel, shows when power is supplied across the heater resistors. A current limiting resistor for the neon bulb is built into the lamp socket.

b. The secondary of transformer T2 consists of three windings. The two smaller windings are used as a filament voltage supply for all the tubes. A 5-volt winding is used to heat the filament of rectifier tube V10. The other tube filaments are supplied from a 13-volt secondary winding, which is tapped at 6.3 volts for all tubes except V5, V6, and V10. The whole 13-volt secondary is used with a series nonlinear resistance tube RT1 to supply regulated filament voltage for tubes V5 and V6. Filter Z9 and r-f choke L7 are r-f bypasses for V5 and V6. R-f bypassing for V3 and V4 is accomplished by filter Z2 and r-f choke L2. I-f tubes V12, V13, and V14 are bypassed for r-f by filter Z12 and capacitor C64. In the equipments after serial number 110, the filament circuits are not connected directly to ground (chassis). This is done to balance out the hum leakage developed between the filament and cathode of tube V5. Figure 30 shows the filament circuit for the later equipments. The filament lead that originally was grounded now has an r-f filter network consisting of choke L36 and filter cartridge Z16. Capacitors C67A and C67B balance the modulator filament leads to ground. With this balance, each lead measures 3.15 volts a-c to the chassis. Potentiometer R107 is connected across the filament leads and the balancing voltage is taken from the slider. Resistor R108 feeds the voltage to the cathode of tube V5 and also limits the current flow. In the i-f filament circuit, capacitor C64 is removed, because it would tend to upset the filament balance. Cartridge filter Z15 is added to filter the filament lead that was removed from ground. A 6-volt pilot lamp I 7 is connected across the 6.3-volt filament supply to serve as an indication of whether or not the signal generator power supply is working. This lamp is mounted behind a red jewel on the front panel and is marked POWER ON. The tuning dial is illuminated by lamps I 1 and I 2 which also are connected across the 6.3-volt winding. The h-v winding is center tapped and feeds its voltage to the plates of rectifier tube V10 which is a full-wave filament-type rectifier. The rectified voltage is fed across bleeder resistor R88. From this point, the B+ current passes through a double pi-section filter which consists of filter chokes L15 and L16 and capacitors C36, C37A, and C37B. After filtering, the B+ voltage is fed to switch S1, section 1 top, which distributes the B+ voltage to the calibration a-f amplifiers, calibration oscillator, harmonic amplifier, 1,000-cps oscillator, modulator a-f amplifier, and the plate circuit of the i-f amplifier. The path for regulated B+ is through resistors R89 and R90, through switch S1, section 1 bottom. This provides

57. I-F Attenuator

(fig. 27)

a. A simplified schematic diagram of the i-f attenuator is shown in figure 27. Any voltage supplied by the i-f output stage passes through the i-f attenuator before reaching the i-f output cable. The attenuator is made up of two switches and a resistor pad which allows 20-db (voltage ratio of 10 to 1) attenuation steps between the contacts in each position of the IF MICROVOLTS switch. The purpose of the pad and switch S4 is to attenuate the input signal and provide a constant impedance to the output cable. The pad consists of resistors R76 through R83. When the IF MICROVOLTS switch is turned to the 1.0 VOLT position, switch S5, which is operated by a cam on S4, allows the direct output of 1 volt from the i-f amplifier stage to be supplied to the i-f output cable. Resistors R75 and R103 are switched into the attenuator output circuit in the 1.0 VOLT position to maintain the necessary output impedance.

b. The output from the attenuator passes through a short length of coaxial cable to jack J6 on the front panel, and then through the front panel through a cable which is permanently connected. The i-f output cable is terminated by resistor R84. Looking into the generator, a 25-ohm output impedance is seen. Connection is made from this cable by means of alligator clips.

58. R-F and I-F Output Metering Circuits

Figure 28 shows, in a simplified form, the metering circuit which measures the voltage inputs to the r-f and i-f output attenuators. Depending on the position of OPERATION switch S1, either the r-f or i-f voltage is measured.

a. In the IF position of S1, a portion of the i-f attenuator input voltage is rectified by crystal diode CR3; filtered of r-f by C35, R71, and filter Z8; passed through R70; and measured by meter M1. Resistor R70 is used for meter calibration.

b. The r-f voltage metering circuit is similar to the circuit described in *a* above. It consists of

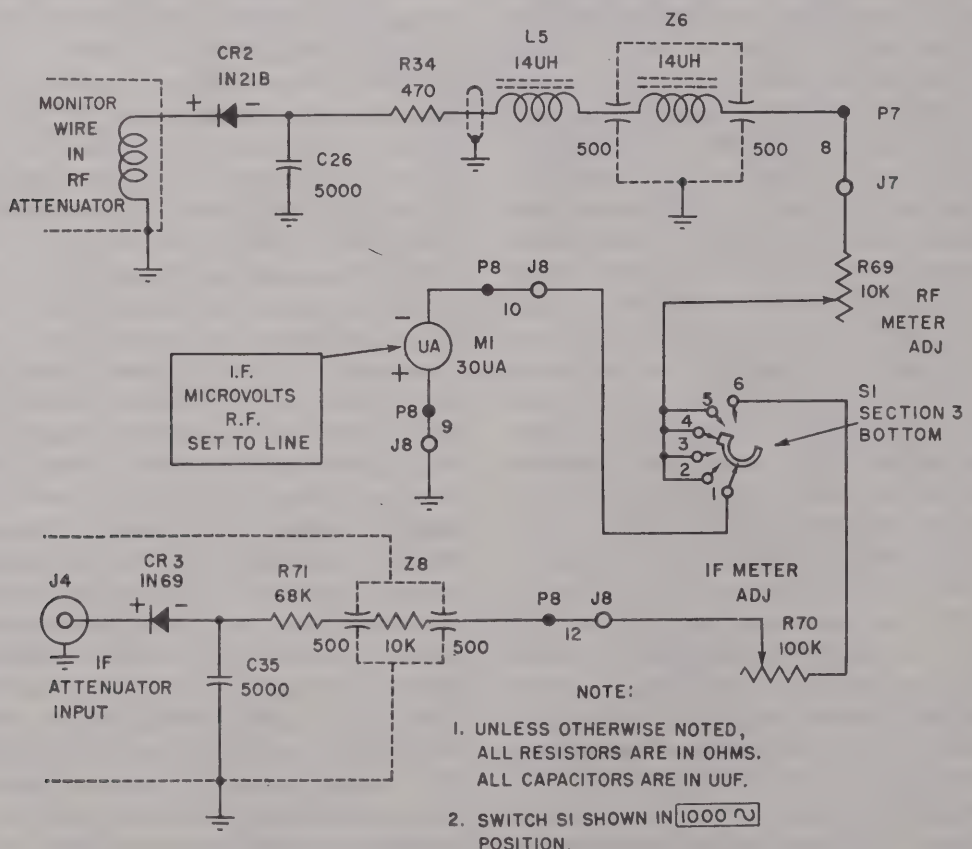

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Figure 28. R-f and i-f output metering circuits.

regulated fixed bias for modulator tube V5 and, in the IF position of S1, regulated plate and screen voltage for the i-f oscillator. Regulation is accomplished by tube V11.

c. Resistor R90 is a current-limiting resistor for the voltage regulating tube. Approximately a 150-volt potential is regulated continuously between ground and pin 5 of tube V11 (OA 2). This regulated voltage is used to supply the critical B+ voltage for the 1,000-cps oscillator tubes V7 and V8, modulator tube V5, r-f oscillator tube V6, i f oscillator tubes V12 and V13, and i-f amplifier stage V14. When switch S1 is in the IF position (6), the regulated 150-volt potential is applied across potentiometer R91. This potentiometer is the IF LEVEL control which varies the screen voltage of i-f amplifier V14.

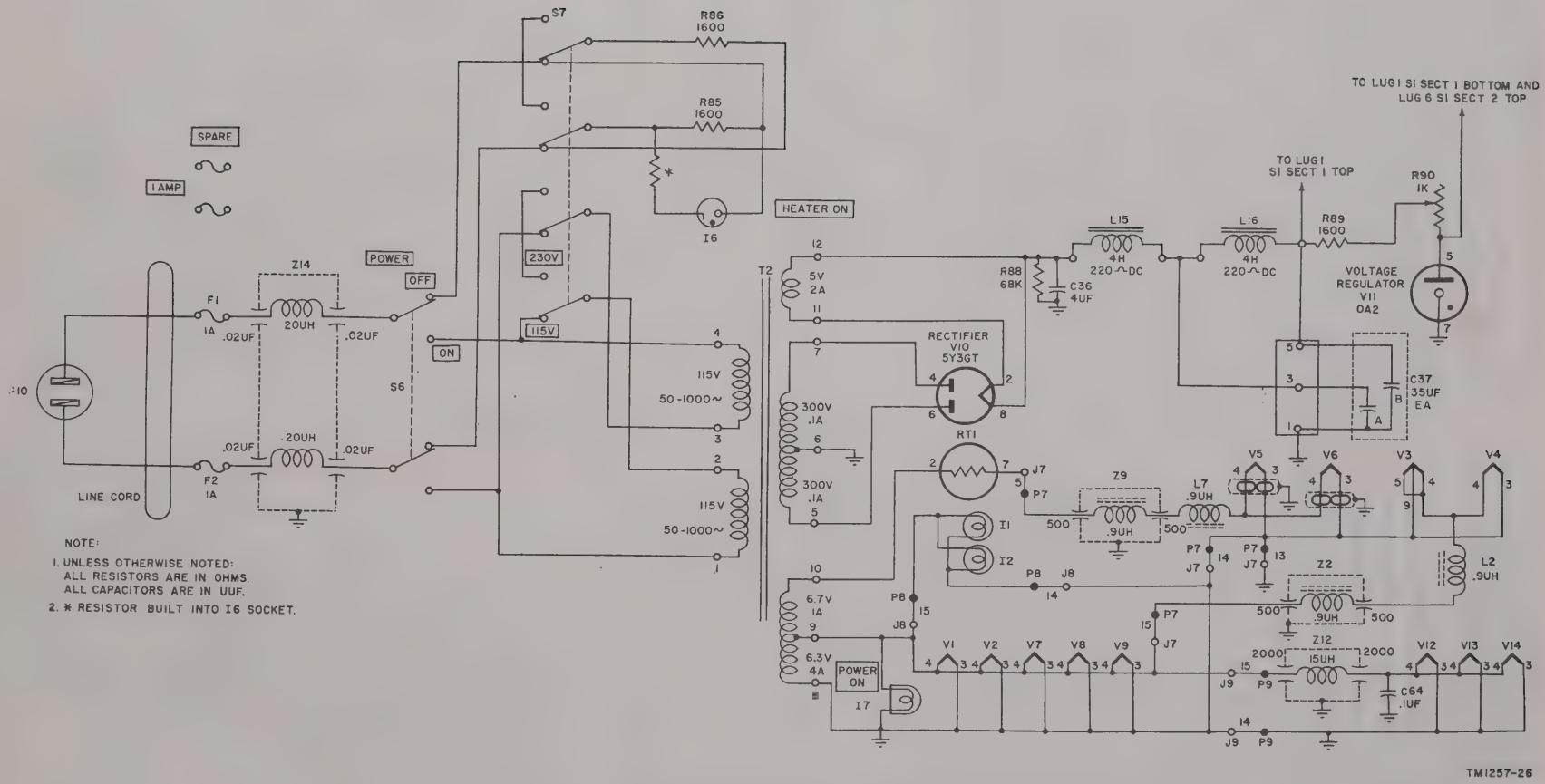


Figure 29. Power supply, simplified schematic diagram.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance. The amount of repair that can be performed is limited by only the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVELS

Warning: There are certain points in the signal generator that operate at voltages above 250 volts. These points are located throughout the chassis and should not be touched while power is applied to the signal generator. Be careful when handling or testing any part of the signal generator while it is connected to the power source.

60. Troubleshooting Procedures

a. General. The first step in servicing a defective signal generator is to sectionalize the fault. Sectionalization means tracing the fault to the major component or circuit responsible for the abnormal operation of the signal generator. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults such as burned-out resistors, arcing, and shorted transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltages and resistances.

b. Component Sectionalization and Localization. A group of tests are listed below which are arranged to simplify and reduce unnecessary work when tracing a trouble to a specific component. The simple tests are used first. Those that follow are more complex. Follow the sequence given. A repairman must be careful to cause no further damage to the signal generator while it is being serviced. In general, the trouble is traced to a section of the signal generator and the faulty component in that section is located and the trouble remedied. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 42) is to locate any visible causes of trouble. Through inspection alone, the repairman may frequently discover the trouble or determine the circuit in which the trouble exists. This inspection is valuable in avoiding additional damage to the signal generator which might occur through improper servicing methods and in forestalling future failures.

(2) *Input resistance measurements.* These measurements (par. 64) prevent further damage to the signal generator from possible short circuits. Since this test gives an indication of the condition of the filter circuits, its function is more than preventive.

(3) *Operational test.* The operational test (par. 65) is important, because it frequently indicates the general location of trouble. In many instances, the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to one another.

(4) *Troubleshooting chart.* The trouble symptoms listed in this chart (par. 66) will aid greatly in localizing trouble.

(5) *Signal substitution.* Signal substitution (par. 68) is not generally used for troubleshooting in a signal generator. However, if the proper signal generators are available, it is possible to use signal substitution to an advantage in some cases.

(6) *Intermittents.* In all of these tests, the possibility of intermittent conditions should not be overlooked. If present, this type of trouble often may be made

to appear by tapping or jarring the signal generator. It is possible that some external connection may cause the trouble. Test wiring for loose connections and move wires and components with an insulated tool, preferably a fiber rod. This may show where a bad connection or a faulty component is located.

61. Troubleshooting Data

Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following troubleshooting data:

Fig. ref.	Description
5	Tube location.
32	Top view of chassis.
33	Bottom view of chassis.
34	Top view of r-f oscillator subassembly.
35	Bottom view of r-f oscillator subassembly.
36	Top view of i-f oscillator subassembly.
37	Bottom view of i-f oscillator subassembly.
38	Cutaway view of i-f attenuator.
39	Voltage and resistance measurements.
40	Resistor-capacitor board locations.
48 and 49	Schematic diagrams.

62. Test Equipment Required for Troubleshooting and Testing

The test equipment required for troubleshooting and testing of Signal Generator SG–12/U is listed below. Available technical manuals associated with the test equipment also are listed.

Test equipment	Publication
Multimeter TS–352/U	TM 11–5527
Electronic Multimeter ME–6A/U.	NAVSHIPS 91,269
Tube Tester I–177	TM 11–2627
Tube Socket Adapter Kit MX–949/U.	TB 11–2627–3
Crystal Rectifier Test Set TS–268(*)/U.	TM 11–1242
Test Set I–49	TM 11–2019
Frequency Calibrator-Meter Set AN/URM–18.	Instruction book with equipment.
Audio Oscillator TS–382A/U	TM 11–2684A
Oscilloscope BC–1060–A	TM 11–2526
Panoramic Indicator IP–173/U	
Spectrum Analyzer TS–723/U	
Signal Generator TS–497A/URR	TM 11–5030

63. General Precautions

Observe the following precautions very carefully whenever servicing the signal generator:

a. Be careful when the signal generator is removed from the dust cover; dangerous voltages are exposed.

b. If the signal generator has been operating for quite some time, use a cloth when removing the metal tube shields and a tube puller to remove the tubes to prevent burning the hand or fingers.

c. When working in the r-f oscillator assembly, do not disturb the placement of parts and be careful not to bend the tuning capacitor plates. This could cause a short circuit or a change of alinement.

d. Do not overtighten screws when assembling mechanical couplings.

e. When changing a component that is held by screws, always replace the lock washers.

f. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part such as a power transformer has a number of connections, tag each lead.

(2) Be careful not to damage other leads by pushing or pulling them out of the way.

(3) Do not use a large soldering iron when soldering small resistors or ceramic capacitors. Overheating of the small parts may ruin them or change their value.

(4) Do not allow drops of solder to fall into parts of the chassis. They may cause short circuits.

(5) A carelessly soldered connection may create new faults. It is very important to make well-soldered joints since a poorly soldered joint is one of the most difficult faults to find.

(6) When a part is replaced in an h-f circuit, it must be placed exactly in the position occupied by the original part. A part which has the same electrical value but different physical size may cause trouble in h-f circuits. Give particular attention to proper grounding when replacing a part; use the same ground as in the original wiring. Failure to observe these precautions may result in loss of oscillation, decreased output, or parasitic oscillations.

(7) *Do not disturb* any of the alinement adjustments unless it definitely has been determined that the trouble is caused by an adjustment.

64. Checking B+ Circuits for Shorts

a. After the B+ line leaves the filter section of the power supply, it is distributed by switch S1. If the B+ voltage is low for any position of the OPERATION switch or if there is no B+ voltage, it is likely that the trouble lies in the power supply circuit. This may be due to a faulty rectifier tube, an open filter choke, or a shorted filter capacitor. When the defect which causes an abnormal B+ voltage condition is in some other circuit, it probably will show up only in one position of OPERATION switch S1. Subparagraph *b* below outlines the methods to be used for checking the circuits. Refer to figure 31 which is a simplified diagram of the B+ distribution throughout the signal generator and the possible paths which could offer short circuits. By using this diagram in conjunction with the voltage and resistance measurements found in figures 39 and 40, the typical causes of trouble can be checked easily.

b. A trouble in any circuit will be noticed when following the operating procedures given in paragraphs 20 through 25. These troubles will be indicated in the equipment performance checklist. Normally, using this procedure will narrow the location to a section of the signal generator or even to one particular stage. Sometimes, if the B+ circuit is shorted in the decoupling network of one stage, it may drop the voltage so that several stages are affected. Most of the checking can be accomplished from the bottom of the chassis or at the decoupling filter networks which have terminals protruding from the sides of the r-f and i-f oscillator assemblies.

65. Operational Test

The operational test is used to check all of the functions of the signal generator. In this test, all positions of the OPERATION switch should be used. All the r-f bands should be tested for output. The CORRECTOR, DEVIATION LEVEL, IF LEVEL, and RF SET TO LINE controls should all be turned to see if they vary their respective circuit signals. If an f-m receiver is available, the r-f output of the signal generator can be fed into it and the results noted. The main idea of this test is to see that no controls are binding and that all of the indications are as they should be from a physical and an electrical standpoint. Refer to the equipment performance checklist (par. 44) to check for the troubles that might be encountered and also their location.

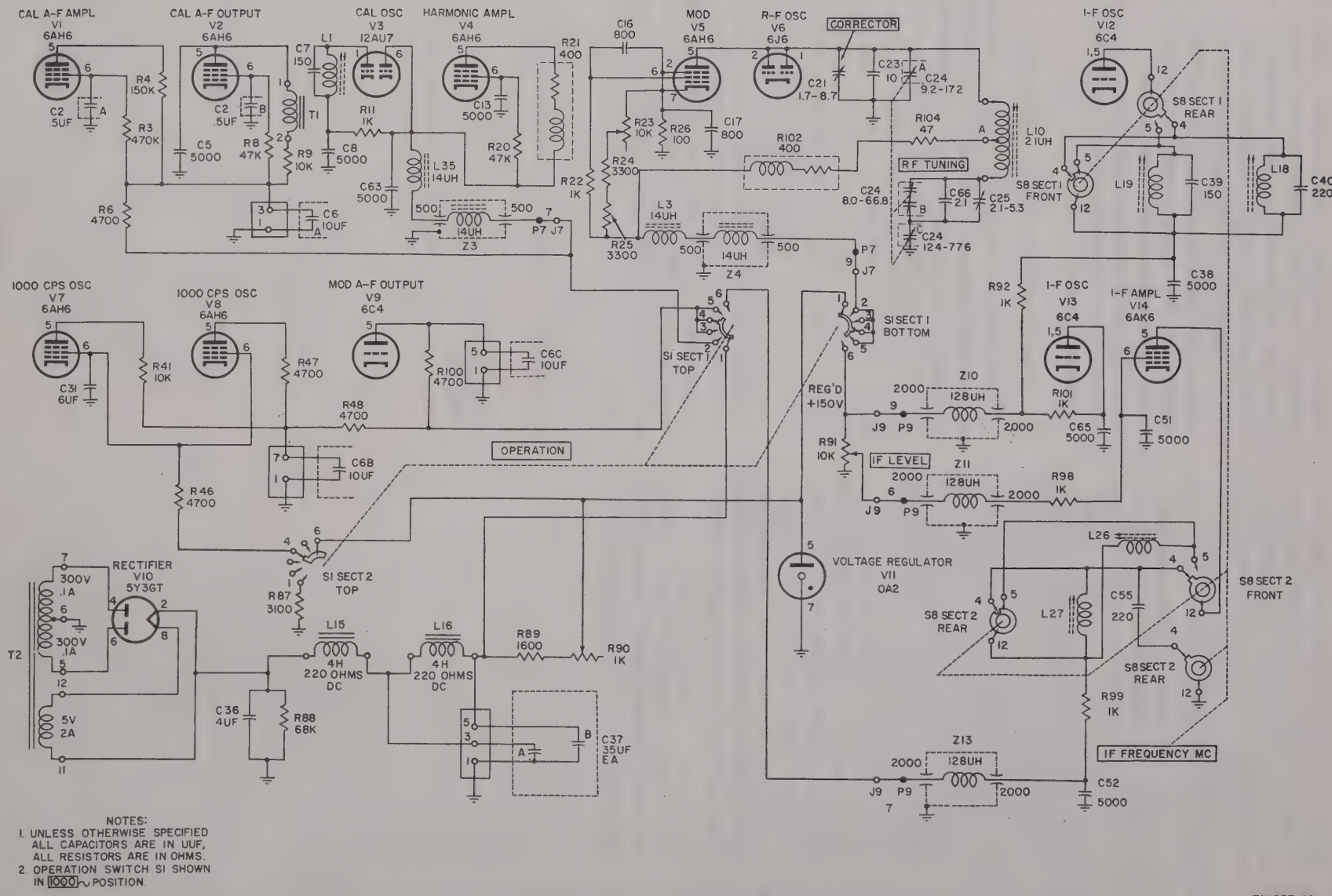

CAL A-F AMPL V1 6AH6
CAL A-F OUTPUT V2 6AH6
CAL OSC V3 12AU7
HARMONIC AMPL V4 6AH6
MOD V5 6AH6
R-F OSC V6 6J6
CORRECTOR
I-F OSC V12 6C4
1000 CPS OSC V7 6AH6
1000 CPS OSC V8 6AH6
MOD A-F OUTPUT V9 6C4
I-F OSC V13 6C4
I-F AMPL V14 6AK6
RECTIFIER V10 5Y3GT
VOLTAGE REGULATOR V11 0A2
S8 SECT 1 REAR
S8 SECT 1 FRONT
S8 SECT 2 REAR
S8 SECT 2 FRONT
S1 SECT 1 TOP
S1 SECT 1 BOTTOM
S1 SECT 2 TOP
RF TUNING
OPERATION
IF LEVEL
IF FREQUENCY MC
REG'D +150V
4H 220 OHMS DC
4H 220 OHMS DC
NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN UUF, ALL RESISTORS ARE IN OHMS.
2. OPERATION SWITCH S1 SHOWN IN 1000 ~ POSITION.
TM1257-28

Figure 31. Signal Generator SG–12/U, B+ voltage distribution

66. Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the signal generator. It lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. The chart also indicates how to localize trouble quickly to the r-f oscillator, crystal calibrator, i-f oscillator, or audio circuits. After the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of the stage or circuit ordinarily should be sufficient to isolate the defective parts. Normal voltage and resistance readings are given in figure 39.

Symptom	Probable trouble	Correction
1. Line cord connected to power source and POWER switch is in the OFF position. The HEATER ON lamp does not light.	1. Defective lamp I 3. Blown fuse F1 and/or F2.	1. Replace lamp. Replace blown fuse with SPARE fuse. If fuse blows again, check line filter Z14 for a short circuit or switch S7 for correct position.
2. POWER switch in ON position. POWER ON or dial lamps do not light.	2. Defective POWER ON or dial lamp.	2. Replace lamp.
3. Fuse F1 and/or F2 blow when POWER switch is moved to ON position. OPERATION switch is in the B+ OFF position.	3. Shorted filter capacitor. Defective rectifier tube V10 or voltage regulator tube V11.	3. Check capacitors C36 and C37. Make a resistance check and replace defective capacitor. Check tubes; replace if defective.
4. OPERATION switch set at CAL position. Noise (hum or hiss) is heard from speaker, but, when the RF TUNING control is turned, no audio beats are heard. BAND SWITCH may be in any position.	4. Defective tubes V3, V4, and V6 and crystal Y10. Defective component in V3, V4, V6 or CR1 circuit.	4. Check tubes and crystal; replace defective part. Makes voltage and resistance checks. Replace defective component.
5. Symptoms are similar to those in step 4 above. However, this occurs only in one band or on the higher bands.	5. Section of turret is defective in inoperative band. Oscillator tube V6 will not oscillate on high bands.	5. Check turret section for defect; replace defective component. Replace tube V6.
6. OPERATION switch in CAL position. Faint audio beats are heard when RF TUNING control is turned.	6. Weak tube V1, V2, V3, or V4. Defective resistor or capacitor in crystal calibrator circuit.	6. Check tubes; replace if weak. Replace defective component.
7. OPERATION switch in CAL position, Audio beats are heard, but drift is great even after 1½-hour warm-up.	7. Defective voltage regulator tube V11 or defective oscillator tube V6. Improper setting of R90.	7. Check oscillator tube by substitution. Replace if found defective. Check V11; replace if defective. Check current through V11. Reset R90 if necessary.
8. OPERATION switch in CAL position, but nothing is heard from speaker.	8. Defective tube V10, V1, or V2 or crystal detector CR1. Open filter choke in power supply or resistor in audio circuit. Shorted capacitor C5 or C6A. Open or shorted speaker LS1 or transformer T1. Interconnecting plugs to front panel and chassis loose or shorted.	8. Check tubes and/or crystal. Replace defective part. Check chokes L15 and L16 and resistor in plate and screen grid circuits of tubes V1 and V2. Check capacitors; replace if defective. Check speaker or transformer; replace defective part. Check plugs for tightness and short circuits.
9. OPERATION switch in MOD OFF position. I. F. MICROVOLTS meter does not indicate when RF SET TO LINE control is turned clockwise, and there is no r-f signal at r-f cable termination head.	9. Defective oscillator tube V6 or its associated components. Loose couplings on attenuator shafts.	9. Check tube and circuit components. Replace defective part. Tighten coupling.

Symptom	Probable trouble	Correction
10. OPERATION switch in MOD OFF position. I. F. MICROVOLTS meter does not indicate when RF SET TO LINE control is turned clockwise, but there is output to unit under test.	10. Defective monitor crystal CR2, meter M1, or other meter circuit component.	10. Check for defective component. Replace if necessary.
11. OPERATION switch in 1000 ~ position. R-f output is obtained from signal generator, but it is unmodulated and the KILOCYLCES DEVIATION meter does not indicate modulation.	11. Defective tube V7, V8, or V9. Defective lamp E3. Defective component in V7, V8, or V9 circuit.	11. Check tube; replace if defective. Check lamp; replace if defective. Check components; replace if defective.
12. OPERATION switch in 1000 ~ position. R-f output is unmodulated but KILOCYCLES DEVIATION meter indicates modulation.	12. Defective modulator tube V5. Faulty component of modulator tube V5 circuit.	12. Check tube by substitution; replace if defective. Check component; replace if defective.
13. OPERATION switch in 1000 ~ position. R-f output is frequency modulated, but full deviation can not be reached on one or all bands when DEVIATION LEVEL control is advanced fully.	13. Weak tubes V7, V8, V9, and V5. Improper setting of R43 or R57 if all bands have low modulation. Improper setting of R58, R59, R60, R61, or R62 if only one band has low modulation. Defective switch S2 or S3 or other modulator circuit component.	13. Check tubes; replace if defective. Readjust proper control after determining if the affected deviation is on all bands. Reset proper control corresponding to affected band. Check switches and components; replace if defective.
14. OPERATION switch in 1000 ~ position. Correct frequency deviation obtained, but distortion at output of r-f cable head is high.	14. Faulty V5 tube. Improper setting of R23 or R43. Defective tube or circuit component in audio oscillator or amplifier stages.	14. Check tube by substitution; replace if defective. Check settings of R23 and R43. Check V7, V8, and V9 by substitution; replace faulty tube or circuit component.
15. OPERATION switch in EXT MOD position. Audio signal is furnished to EXT MOD terminals, but no frequency modulated output is obtained.	15. Not enough audio signal applied to terminals. Defective component in Z7 or defective switch S1, section 4.	15. Readjust input signal from audio oscillator. Check component; replace if defective.
16. OPERATION switch in IF position. Output is obtained from i-f cable, but no indication is shown on I. F. MICROVOLTS meter.	16. Defective metering circuit.	16. Check components of metering circuit.
17. OPERATION switch in IF position. No output obtained. I. F. MICROVOLTS meter indicates i-f signal being fed to attenuator.	17. Disconnected cable to front panel from attenuator or broken connection in i-f cable.	17. Check cable connections; repair cable if necessary.
18. OPERATION switch in IF position. No i-f output, and I. F. MICROVOLTS meter does not indicate, or i-f output is obtained in all but one position.	18. Connection between jack J9 and plug P9 loose. Defective tube V12, V13, or V14. Defective i-f oscillator or i-f amplifier circuit.	18. Tighten jack and plug connection. Check tubes and crystals; replace defective part. Check circuits in i-f oscillator and amplifier; replace defective component.

Symptom	Probable trouble	Correction
19. OPERATION switch in IF position. Meter indicates weak i-f output.	19. Incorrect setting of I. F. MICROVOLTS meter adjustment R70. Weak i-f amplifier tube V14, i-f oscillator tubes V12, or V13 or weak crystals. Misalinement of oscillator and/or i-f amplifier circuits.	19. Readjust R70 if necessary. Check tubes, replace if weak. Check crystal by turning IF FREQUENCY MC to another position. If output goes up to normal, crystal is defective. Check by turning IF FREQUENCY MC to another position. If the output goes to normal, the oscillator and amplifier circuits are probably out of alinement. Refer to alinement procedures.

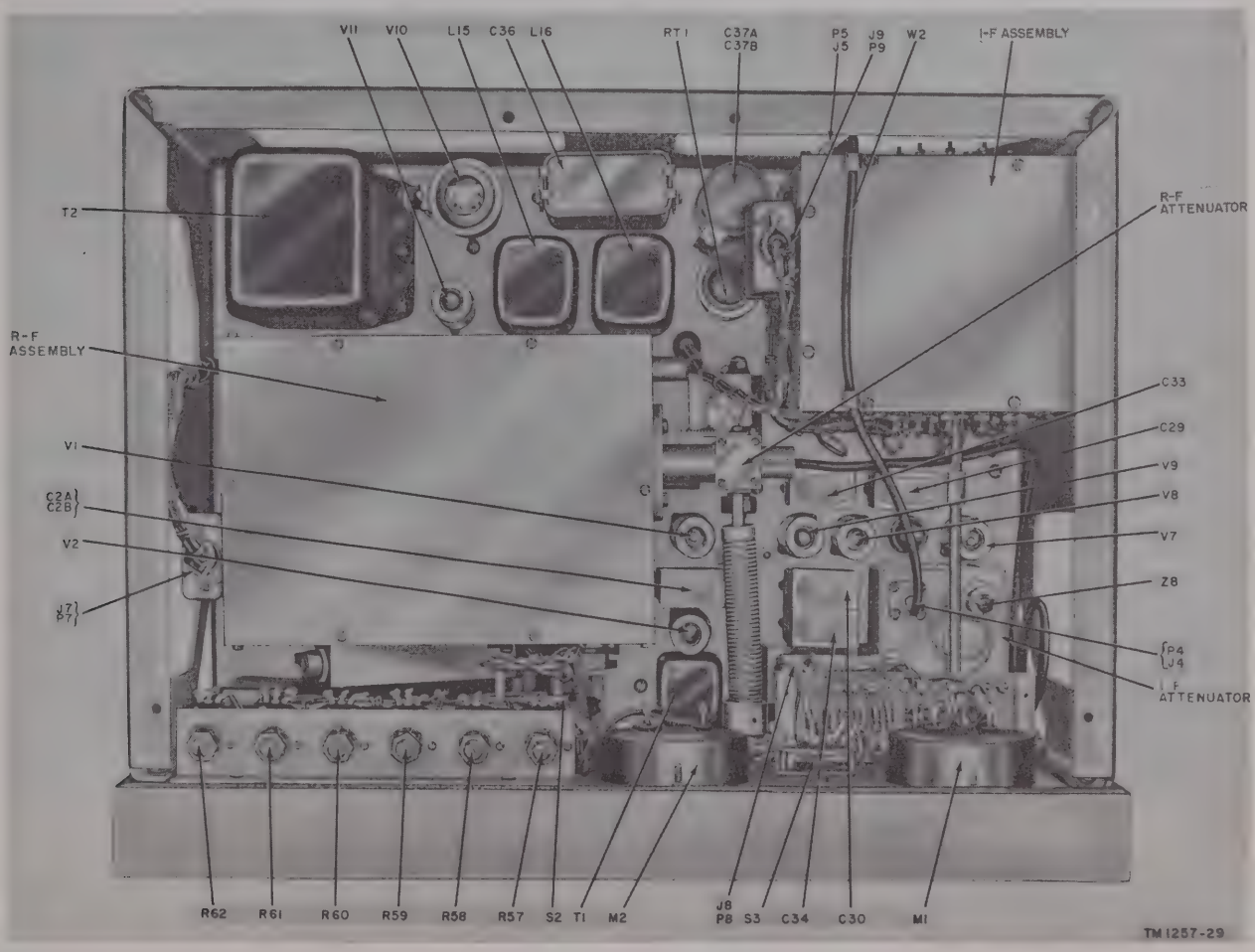


Figure 32. Signal Generator SG–12/U, top view of chassis.

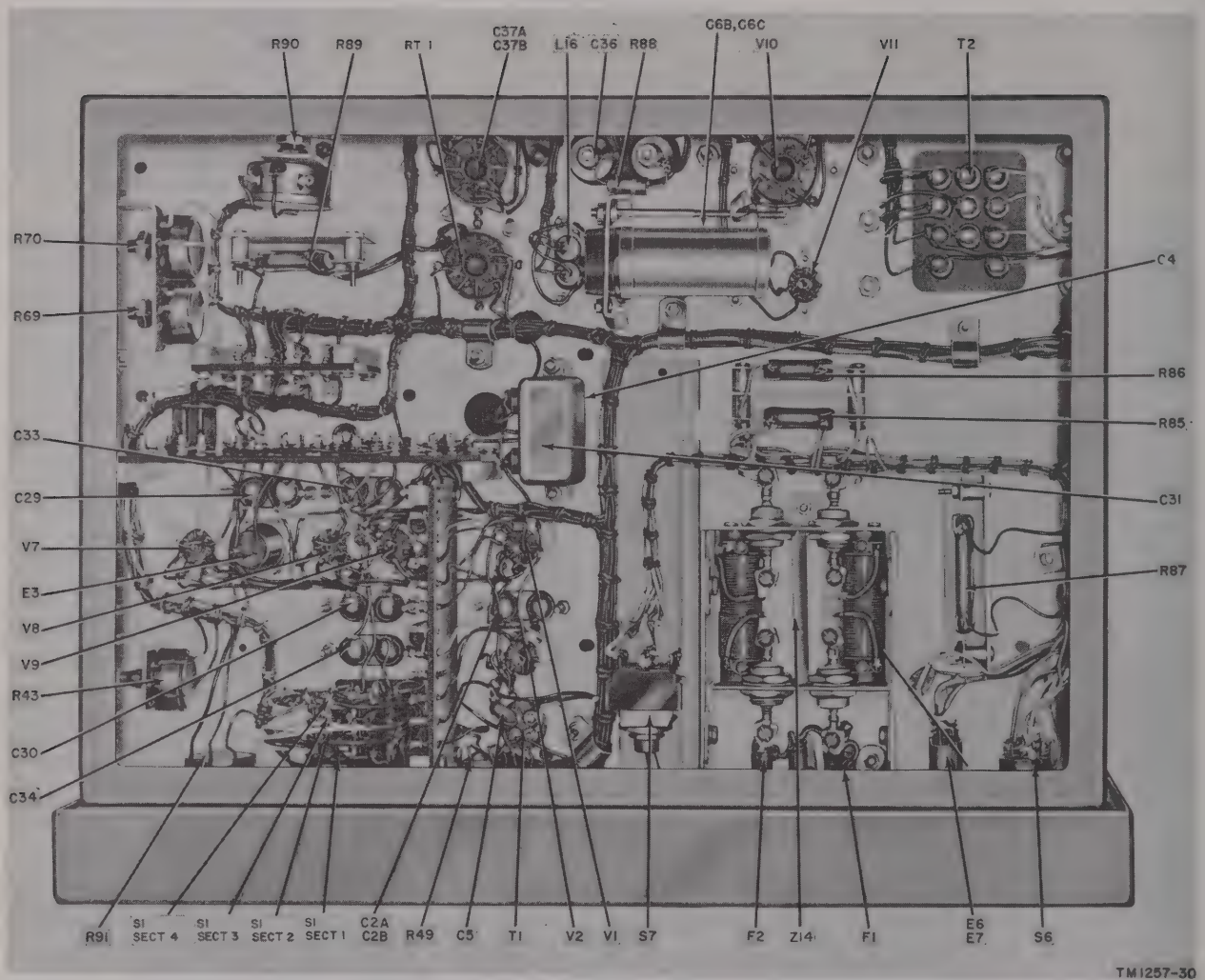


Figure 33. Signal Generator SG–12/U, bottom view of chassis.

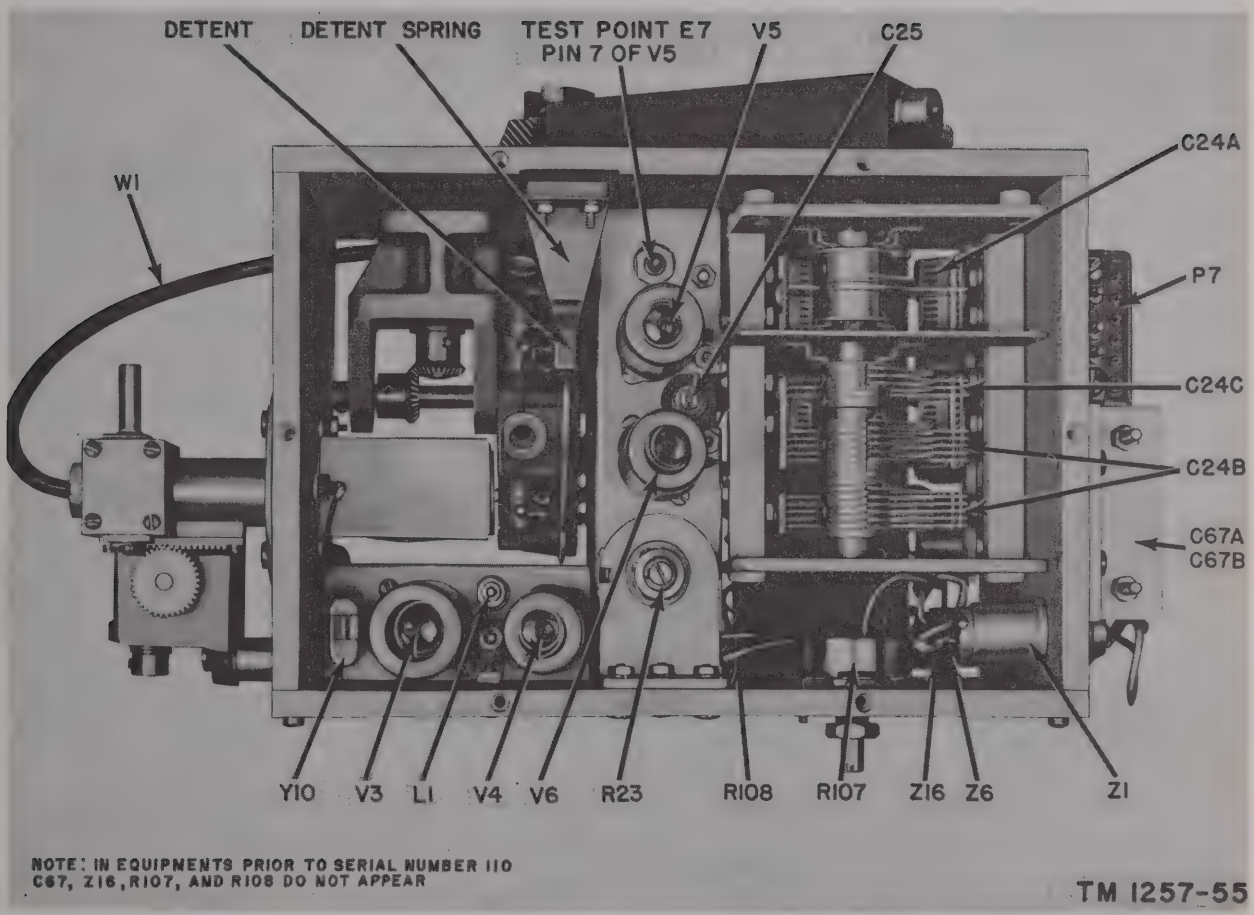


Figure 34. R-f oscillator subassembly, top view.

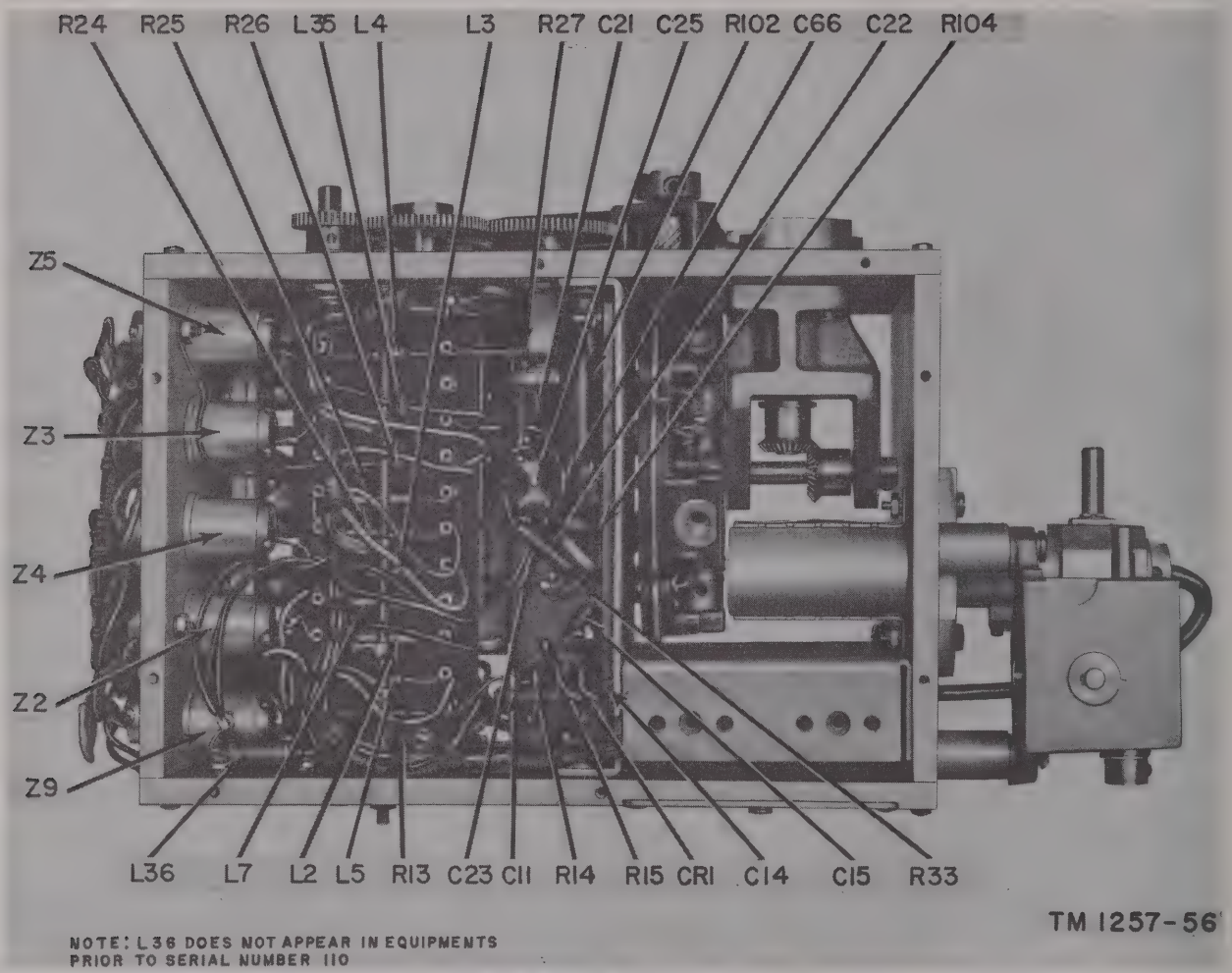


Figure 35. R-f oscillator subassembly, bottom view.

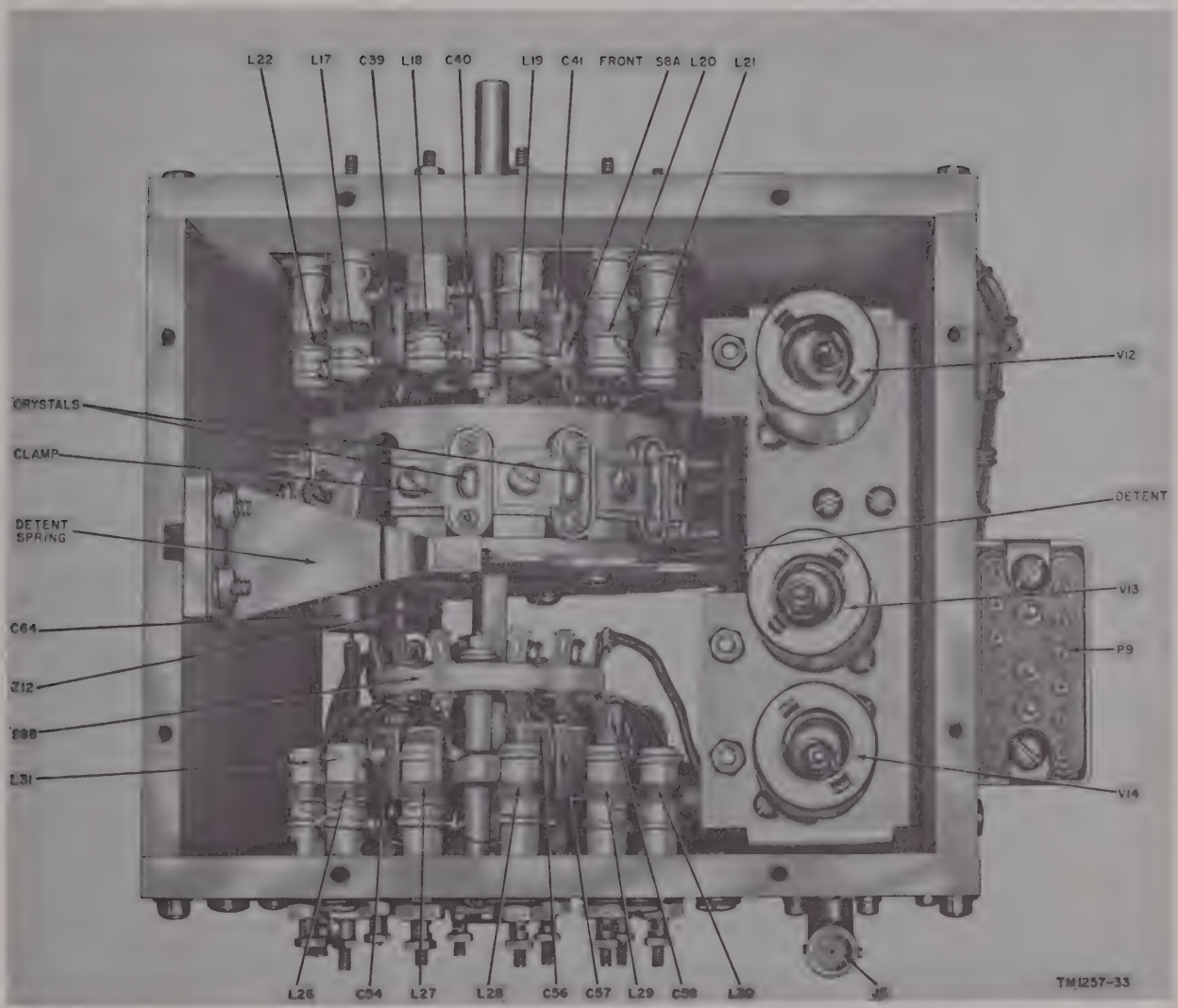


Figure 36. I-f oscillator subassembly, top view.

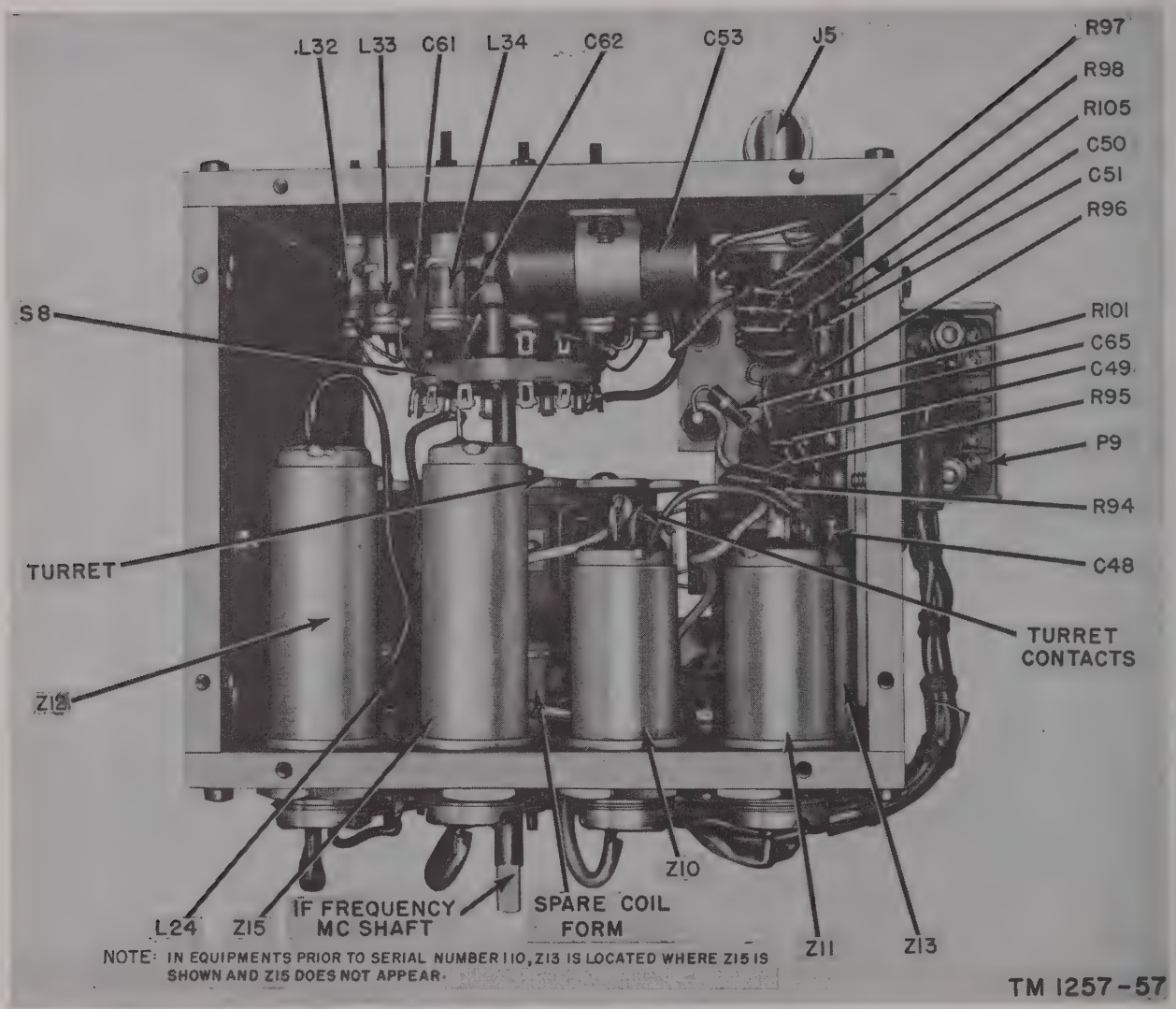


Figure 37. I-f oscillator subassembly, bottom view.

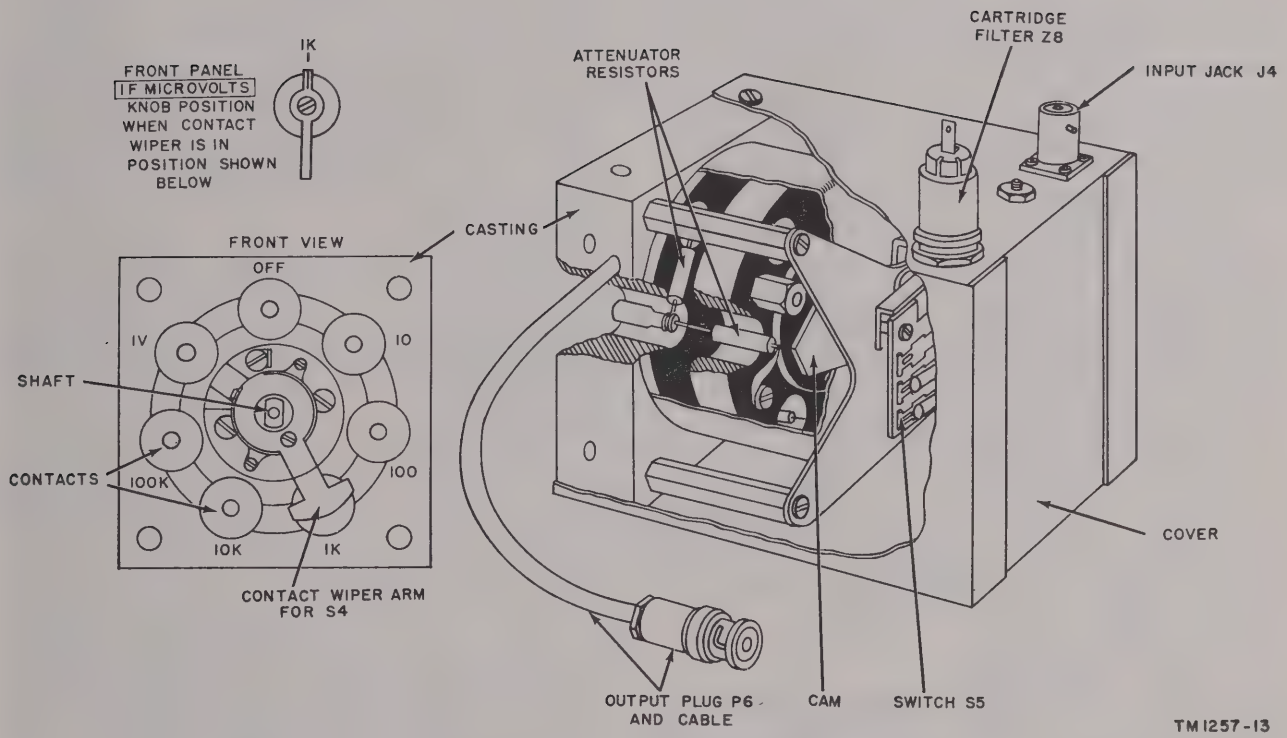


Figure 38. Cutaway view of i-f attenuator.

67. Checking Parts

Most of the parts used in the signal generator have smaller tolerances than those used in most field radio equipment. Sometimes the ordinary methods of testing these parts are not adequate because they do not indicate whether the part is able to function properly in the generator circuits. This condition requires more precise testing and reliable testing equipment.

a. An example of the small tolerances which must be held is found in the resistors of the i-f attenuator unit and DEVIATION RANGE attenuator networks. Each resistor must be exactly of the correct value or the entire network resistance will be incorrect and cause inaccurate deviation indications or incorrect output signal levels. An ordinary ohmmeter usually is not accurate enough; therefore, a Wheatstone bridge, such as Test Set I–49, must be used to check the individual resistances of this type of circuit.

b. The crystals used in the signal generator may oscillate in a test circuit but will not operate when put into the signal generator. This causes a misleading indication that the crystal is good and that some other part of the circuit is defective. The best method of checking crystals is by direct substitution when spare crystals are available.

c. Tubes in some of the critical circuits also must be checked by substitution. The modulator, the r-f oscillator, and the audio oscillator tubes cannot be tested by using a tube tester. Sometimes several tubes must be substituted to get the desired results.

68. Signal Substitution

a. Signal substitution requires a source of either audio or i-f signals. Since there are no amplifier stages in the r-f circuit, signal substitution in the r-f oscillator stage is not used. For the other circuits, use a suitable signal generator with a frequency in the range of the stages to be tested. When a signal is supplied to the input of a stage, place an oscilloscope or meter across the output load of that stage to indicate the presence of the applied signal.

b. To check i-f amplifier V14, insert a signal at the grid with the same frequency that is indicated by the IF FREQUENCY MC control. The OPERATION switch must be in the IF position. If no signal is present at the output, the amplifier circuit is faulty. If the proper signal is indicated at the i-f output, then the fault probably lies in the i-f oscillator circuits of tubes V12 and V13.

c. To check the calibrator amplifiers, a signal may be inserted at the grid of either of the two calibrator a-f amplifier stages. For best results, work from the output stage V2, back toward crystal detector CR1. The audio signal is first applied to the grid of tube V2. If a signal is heard from the panel speaker, the output audio stage can be considered to be operating correctly and the input signal can be moved to the grid of V1. If, in either case, no signal is heard from the speaker, the last stage tested can be assumed to be faulty and further testing is required for voltage and resistance conditions which are not normal. An audio signal may be inserted at the output side of crystal CR1 as the final audio check. If no signal is obtained from the speaker, and the calibrator amplifier and a-f oscillator circuits are functioning properly, the trouble probably lies in a defective crystal, CR1. Check this crystal in a crystal testing unit; or, if the unit is not available, check it by substitution.

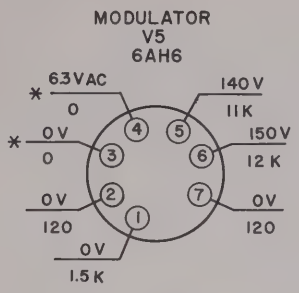
d. The tests in the audio circuit of the calibrator unit (*a* and *c* above) were completed with the consideration that calibration oscillator V3 and amplifier V4 circuits were not in operation; they can be checked in a method similar to the i-f amplifier test.

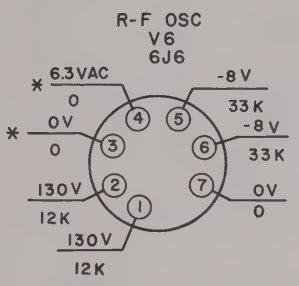
e. When a trouble is localized to a given stage or circuit, first test the tube, if such a test is indicated, then measure the voltage, and finally measure the resistance at the tube socket of that stage. When making voltage measurements, if a zero or a very low voltage not called for on the voltage chart is indicated, immediately remove the power from the signal generator and check for a shorted capacitor. This may prevent excessive current from passing through a choke or resistor which could cause the resistor or choke to burn out.

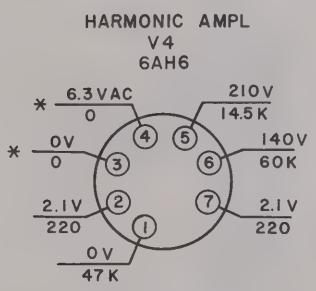
f. Trouble in a circuit or stage is not always indicated by an incorrect voltage or resistance measurement at the tube socket. An open bypass or coupling capacitor could cause trouble which would not show up in ordinary measurements.

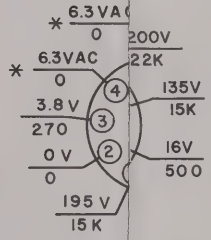
g. Remove only one tube at a time when testing. Check the number of the tube, test the tube and, if it is not defective, return it to its proper socket before removing another tube. The proper operation of some circuits depends on the particular tube being used, and any change of tubes may cause misalinement of that circuit.

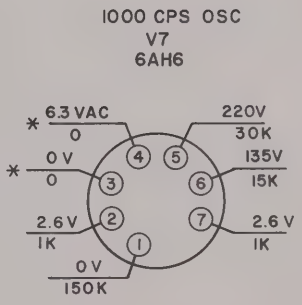
h. At each stage, it is assumed that tests of all previous stages were completed satisfactorily. Isolate and clear any trouble located before pro-





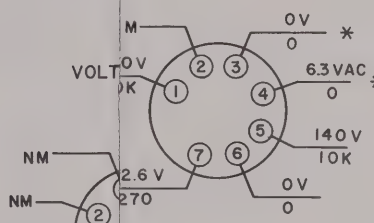


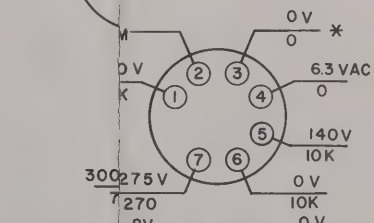


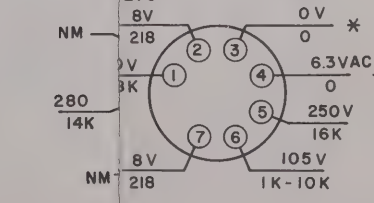


1. LINE VOLTAGE 115 VOLTS.
2. ALL RESISTANCES ARE IN OHMS.
3. NM MEANS NOT MEASURED.
4. USE 20,000 OHM-PER- VOLT METER FOR D-C VOLTAGE MEASUREMENTS.
5. VOLTAGES AND RESISTANCES FOR V1, V2, V3, AND V4 MEASURED WITH OPERATION SWITCH IN CAL POSITION.
6. VOLTAGES AND RESISTANCES FOR V5, V6, V7, V8, AND V9 MEASURED WITH OPERATION SWITCH IN 1000 ~ POSITION.
7. VOLTAGES AND RESISTANCES FOR V12, V13, AND V14 MEASURED WITH OPERATION SWITCH IN I F POSITION.
8. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.

* IN EQUIPMENTS AFTER SERIAL NUMBER 110, MEASUREMENTS AT TUBE PINS MARKED WITH AN ASTERISK ARE 3.15 VAC AND 100 K OHMS.







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67. Checking Parts

Most of the parts used in the signal generator have smaller tolerances than those used in most field radio equipment. Sometimes the ordinary methods of testing these parts are not adequate because they do not indicate whether the part is able to function properly in the generator circuits. This condition requires more precise testing and reliable testing equipment.

a. An example of the small tolerances which must be held is found in the resistors of the i-f attenuator unit and DEVIATION RANGE attenuator networks. Each resistor must be exactly of the correct value or the entire network resistance will be incorrect and cause inaccurate deviation indications or incorrect output signal levels. An ordinary ohmmeter usually is not accurate enough; therefore, a Wheatstone bridge, such as Test Set I–49, must be used to check the individual resistances of this type of circuit.

b. The crystals used in the signal generator may oscillate in a test circuit but will not operate when put into the signal generator. This causes a misleading indication that the crystal is good and that some other part of the circuit is defective. The best method of checking crystals is by direct substitution when spare crystals are available.

c. Tubes in some of the critical circuits also must be checked by substitution. The modulator, the r-f oscillator, and the audio oscillator tubes cannot be tested by using a tube tester. Sometimes several tubes must be substituted to get the desired results.

68. Signal Substitution

a. Signal substitution requires a source of either audio or i-f signals. Since there are no amplifier stages in the r-f circuit, signal substitution in the r-f oscillator stage is not used. For the other circuits, use a suitable signal generator with a frequency in the range of the stages to be tested. When a signal is supplied to the input of a stage, place an oscilloscope or meter across the output load of that stage to indicate the presence of the applied signal.

b. To check i-f amplifier V14, insert a signal at the grid with the same frequency that is indicated by the IF FREQUENCY MC control. The OPERATION switch must be in the IF position. If no signal is present at the output, the amplifier circuit is faulty. If the proper signal is indicated at the i-f output, then the fault probably lies in the i-f oscillator circuits of tubes V12 and V13.

c. To check the calibrator amplifiers, a signal may be inserted at the grid of either of the two calibrator a-f amplifier stages. For best results, work from the output stage V2, back toward crystal detector CR1. The audio signal is first applied to the grid of tube V2. If a signal is heard from the panel speaker, the output audio stage can be considered to be operating correctly and the input signal can be moved to the grid of V1. If, in either case, no signal is heard from the speaker, the last stage tested can be assumed to be faulty and further testing is required for voltage and resistance conditions which are not normal. An audio signal may be inserted at the output side of crystal CR1 as the final audio check. If no signal is obtained from the speaker, and the calibrator amplifier and a-f oscillator circuits are functioning properly, the trouble probably lies in a defective crystal, CR1. Check this crystal in a crystal testing unit; or, if the unit is not available, check it by substitution.

d. The tests in the audio circuit of the calibrator unit (*a* and *c* above) were completed with the consideration that calibration oscillator V3 and amplifier V4 circuits were not in operation; they can be checked in a method similar to the i-f amplifier test.

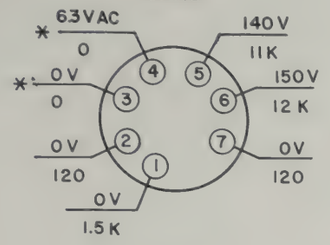
e. When a trouble is localized to a given stage or circuit, first test the tube, if such a test is indicated, then measure the voltage, and finally measure the resistance at the tube socket of that stage. When making voltage measurements, if a zero or a very low voltage not called for on the voltage chart is indicated, immediately remove the power from the signal generator and check for a shorted capacitor. This may prevent excessive current from passing through a choke or resistor which could cause the resistor or choke to burn out.

f. Trouble in a circuit or stage is not always indicated by an incorrect voltage or resistance measurement at the tube socket. An open bypass or coupling capacitor could cause trouble which would not show up in ordinary measurements.

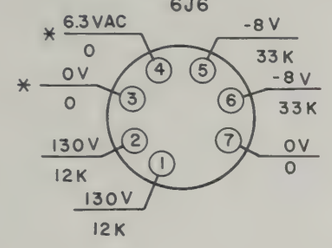
g. Remove only one tube at a time when testing. Check the number of the tube, test the tube and, if it is not defective, return it to its proper socket before removing another tube. The proper operation of some circuits depends on the particular tube being used, and any change of tubes may cause misalinement of that circuit.

h. At each stage, it is assumed that tests of all previous stages were completed satisfactorily. Isolate and clear any trouble located before pro-

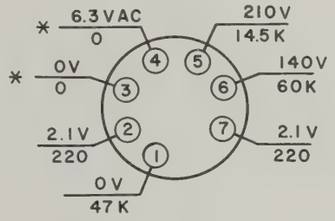
MODULATOR
V5
6AH6



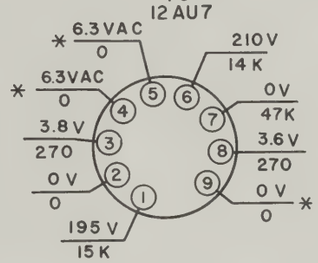
R-F OSC
V6
6J6



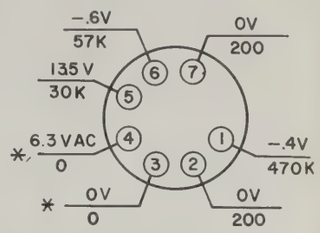
HARMONIC AMPL
V4
6AH6



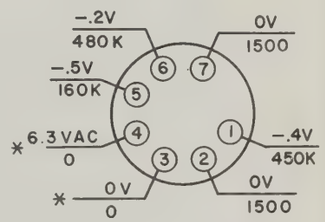
CAL OSC
V3
12AU7



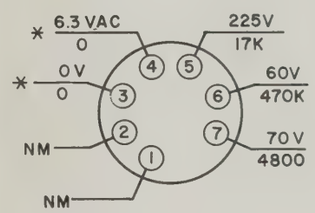
CAL A-F OUTPUT
V2
6AH6



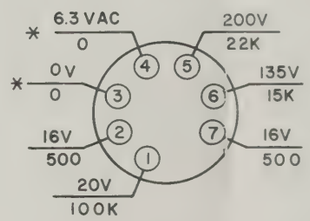
CAL A-F AMPL
V1
6AH6



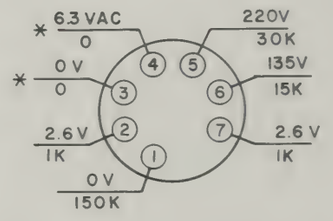
MOD A-F OUTPUT
V9
6C4



1000 CPS OSC
V8
6AH6



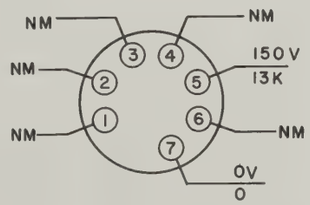
1000 CPS OSC
V7
6AH6



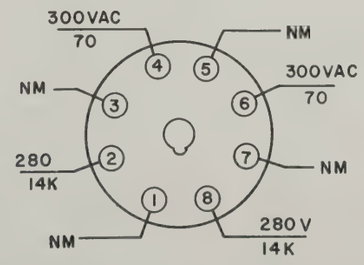
1. LINE VOLTAGE 115 VOLTS.
2. ALL RESISTANCES ARE IN OHMS.
3. NM MEANS NOT MEASURED.
4. USE 20,000 OHM-PER- VOLT METER FOR D-C VOLTAGE MEASUREMENTS.
5. VOLTAGES AND RESISTANCES FOR V1, V2, V3, AND V4 MEASURED WITH OPERATION SWITCH IN CAL POSITION.
6. VOLTAGES AND RESISTANCES FOR V5, V6, V7, V8, AND V9 MEASURED WITH OPERATION SWITCH IN 1000 ∩ POSITION.
7. VOLTAGES AND RESISTANCES FOR V12, V13, AND V14 MEASURED WITH OPERATION SWITCH IN I.F POSITION.
8. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.

* IN EQUIPMENTS AFTER SERIAL NUMBER 110, MEASUREMENTS AT TUBE PINS MARKED WITH AN ASTERISK ARE 3.15 VAC AND 100 K OHMS.

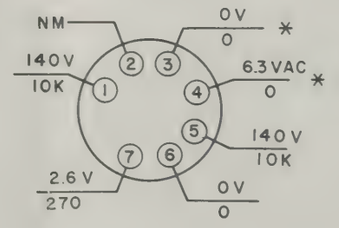
VOLTAGE REGULATOR
V11
0A2



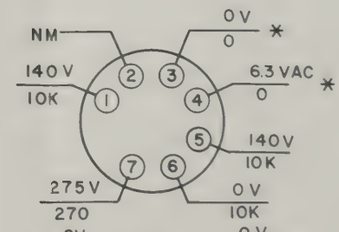
RECTIFIER
V10
5Y3GT



I-F OSC
V12
6C4



I-F OSC
V13
6C4



I-F AMPL
V14
6AK6

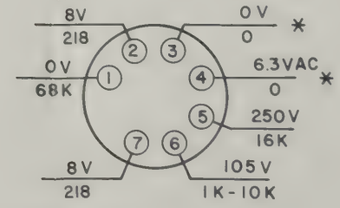


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Figure 39. Signal Generator SG-12/U, voltage and resistance diagram.

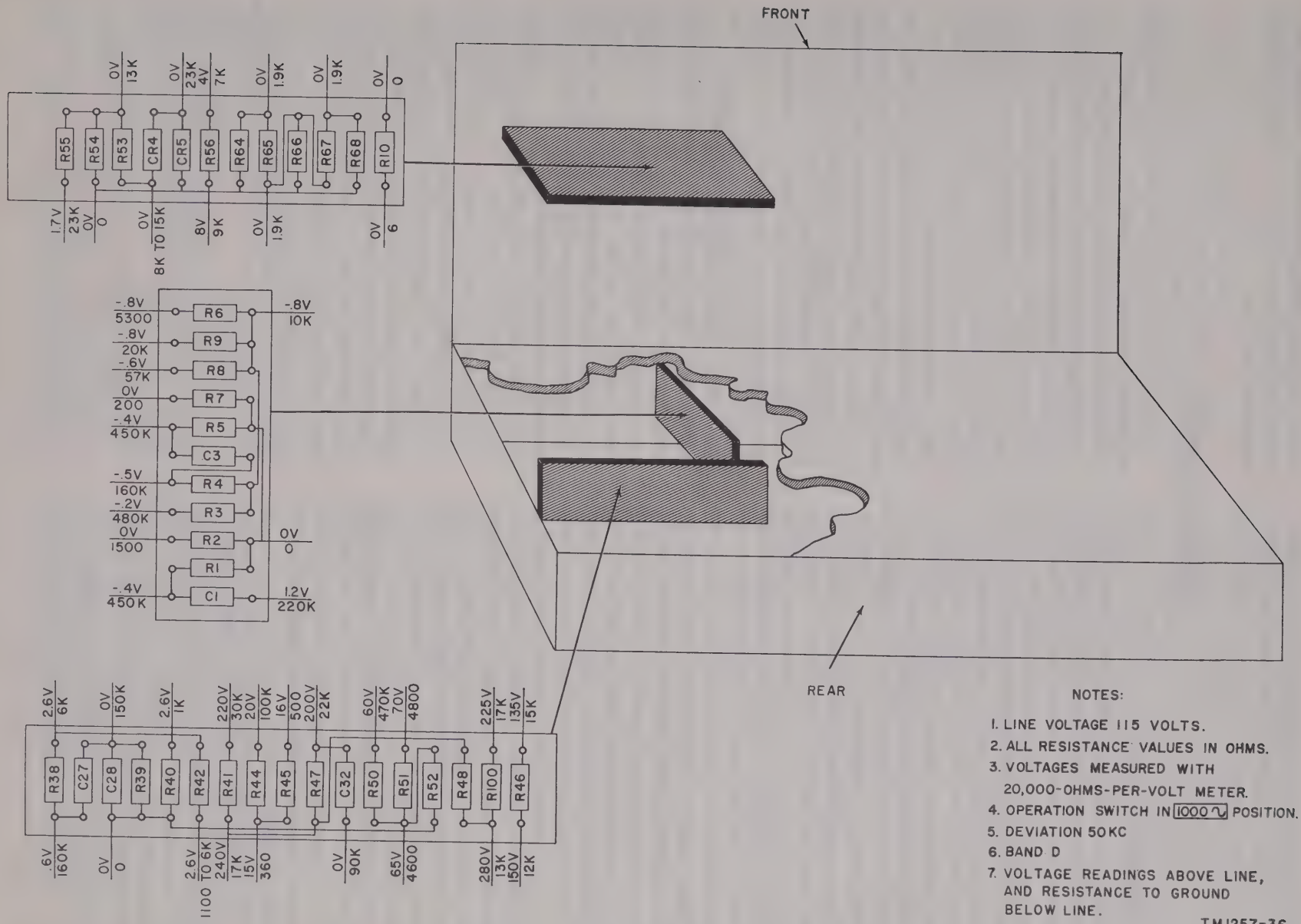


Figure 40. Signal Generator SG–12/U, resistor-capacitor board location diagram.

ceeding with any succeeding steps. It is possible that one trouble may cause more troubles along the line in the signal generator; therefore, just putting one circuit back into operation may not completely return the signal generator to its proper working condition.

Section II. REPAIRS

69. Replacement of Parts

a. For any major work that is to be done on the chassis of the signal generator, first remove the generator from the dust cover. To do this, unscrew the four captive screws on the rear of the dust cover and pull the generator away from the dust cover. For the smaller components such as resistors, capacitors, and r-f chokes, there are no special instructions necessary for replacement. However, when the r-f, i-f, and attenuator assemblies are to be replaced, follow the instructions in paragraphs 70 through 72. The miniature tubes are surrounded and secured by metal shields. Remove the shields by pushing them toward the socket and twisting them slightly counterclockwise until the lock releases. Then pull them away from the tube. Rectifier tube V10 is held in the socket by a hat clamp. To remove the clamp, lift up on the clamp handle. Replace the clamp by setting it on top of the tube and pushing the handle down so that the clamp screw passes through the screw hole. Use enough downward pressure to hold the tube firmly in place and, at the same time, make sure that the clamp will not spring upward.

b. To gain access to the tubes in the r-f and i-f assemblies, remove the assembly top covers by removing all the cover retaining screws. Monitor crystal CR2 is located under a snap cover at the top of the attenuator housing which is inside the r-f assembly. Snap this cover off for access to the crystal.

c. The oscillator crystals in the i-f assembly are retained in the turret by means of flat clamps (fig. 36). To remove the crystals, loosen the clamp screw and turn the clamp so that it is out of contact with the crystal.

d. All knobs, except the RF TUNING and the RF ATTENUATOR MICROVOLTS knobs, are held by a screw through the center of the knobs. When removing the knobs, make a note of the position of the pointer and shaft so that the knobs can be replaced in their original positions.

70. Removal of R-F Oscillator Assembly

To remove the r-f oscillator assembly from the chassis, use the following procedure:

a. Remove the chassis brace directly above the r-f oscillator assembly.

b. Separate the plug P7 and the connector J7.

c. Disconnect the coaxial cable leading from the r-f attenuator to the front panel.

d. Disengage the mechanical couplings on the CORRECTOR, RF TUNING, RF ATTENUATOR MICROVOLTS, RF LEVEL, and BAND SWITCH controls at the points where the interlocking couplings are used.

e. Remove the four r-f oscillator assembly retaining screws from the bottom of the chassis.

f. Slowly lift the r-f assembly out of the chassis see that no force is put on the gears or other parts during the disassembly procedure.

g. Reassemble the r-f assembly by reversing the above procedure.

71. Removal of I-F Oscillator Assembly

To remove the i-f oscillator assembly from the chassis, proceed as follows:

a. Remove the top chassis brace directly above the i-f assembly.

b. Separate interconnecting plug P9 and jack J9.

c. Disconnect the coaxial cable that is connected to the top of the i-f attenuator.

d. Loosen the front setscrews on the IF FREQUENCY MC shaft coupling.

e. Remove the four i-f assembly retaining screws from the bottom of the chassis.

f. Move the i-f assembly toward the rear of the chassis to disengage the coupling and shaft.

g. Lift the i-f unit from the chassis.

h. Reassemble the i-f oscillator assembly, by reversing the above procedure.

72. Removal of I-F Attenuator

To remove the i-f attenuator from the chassis, proceed as follows:

a. Disconnect the coaxial cables from the i-f assembly and from the attenuator to the front panel. Also unsolder the meter monitor wire from filter Z8.

b. Remove the front panel knob from the attenuator shaft.

c. Loosen the front setscrews on the IF FREQUENCY MC shaft coupling.

d. Remove tubes V7 and V8 and lamp I3 from their sockets.

e. Remove the four attenuator retaining screws from the bottom of the chassis.

f. Remove the four i-f assembly retaining screws from the bottom of the chassis and slide the i-f assembly toward the rear of the chassis.

g. Move the attenuator to clear shaft from the front panel and lift it from the chassis. If the i-f assembly is to be used while the attenuator is out of the chassis, replace the four retaining screws.

h. Reassemble the i-f attentuator by reversing the above procedure.

73. Refinishing

Instructions for refinishing badly marred panels are given in TM 9–2851. A quick-drying gray lacquer, matching the original finish, is recommended.

74. Adjustment of RF TUNING Dial Clutch

There is a clutch on the vernier knob for the RF TUNING dial to prevent damage to the mechanical sections of the tuning assembly. The clutch action is caused by a ball bearing drag on the dial shaft. The ball is spring-loaded. The friction between the ball and the shaft is adjusted by a setscrew in the edge of the knob. Tighten the screw to cause enough friction so that the knob will turn the tuning dial. When a stop is reached, the knob should turn without turning the tuning dial; that is, it should slip on the shaft when against a stop but turn the tuning dial when turned away from a stop.

75. Setting Main Tuning Dial Stops

(fig. 12)

If the r-f tuning dial stops are not set correctly, the ganged capacitors may become damaged. When repairs are being made which necessitate the replacement of the tuning gang or any other part connected with the r-f mechanism, it is possible that the dial stops may be set incorrectly. To set the r-f tuning dial stops correctly, use the following procedure:

a. Remove the BAND SWITCH knob, the vernier RF TUNING dial, the dial light caps, and the dial cover.

b. Loosen the setscrews holding the stop cam and the rear section of the capacitor coupling.

c. Set the main tuning dial so that the vernier knob is turned fully counterclockwise and the zero on the dial scale is directly under the hairline Maintain this position of the dial throughout the procedure.

d. Rotate the stop cam counterclockwise to engage the stop lever; then tighten the cam setscrews.

e. Turn the lower tuning gang gear on the r-f oscillator assembly; use the finger or thumb to provide motion. *To avoid possible damage to the capacitor gang, do not apply too much pressure to the gear when the gang reaches the end of its travel.* Set the capacitor gang *near* the fully meshed position so that the edges of the rotor and stator plates are nearly parallel but there is a $\frac{1}{32}$-inch space between the edges of the stator plates and the rotor plate strap.

f. When the correct spacing is achieved, tighten the setscrews on the gang capacitor coupling.

g. When the stops have been set, replace the parts by reversing the sequence given for their removal; then tighten the r-f tuning vernier knob so that its zero is under the line indicator.

76. Adjustment of Dial Mask and Switch S2

(fig. 12)

The dial mask indicates the position of the turret in the r-f oscillator assembly. When the mask and turret are alined perfectly, switch S2 also must be in the correct position. Usually, the best time to adjust the turret mask is when the dial cover is off for the setting of the tuning dial stops. Correctly adjust the dial mask and switch S2 in the following manner:

a. Rotate the BAND SWITCH until the setscrew on the chain sprocket gear is accessible. The chain sprocket gear is located on a common shaft between switch S2 and the front panel.

b. Loosen the setscrews in the chain sprocket gear. The switch shaft now may be rotated independently of the turret or the BAND SWITCH knob.

c. Identify the position of the turret by the coil in use. When the coil is in use it is directly opposite the opening at the end of the attenuator. The coil with the least number of turns is band E.

d. Rotate the switch shaft to place the switch wiper in proper contact with relation to the turret band position. Identify switch S2 position by tracing the lead from the lug of the switch to the adjustment potentiometer on the bracket of the front panel. These adjustments correspond to separate bands and may be identified on the overall schematic diagram (figs. 48 and 49).

e. When the switch is in the proper position in relation to the turret, tighten the setscrews on the chain sprocket gear.

f. To set the dial mask, remove the BAND SWITCH knob, the vernier dial, the dial light caps, and the dial cover. With the turret in the same position as described in *e* above, loosen the shaft locking nut on the mask and turn the mask to the band opening which corresponds to the position of the turret. Hold the mask in that position and tighten the shaft locking nut.

g. Replace the dial cover, the dial light caps, the vernier knob, and the BAND SWITCH knob.

77. Setting Corrector Stops

(fig. 12)

a. Loosen the setscrew on the CORRECTOR drive gear.

b. Rotate the CORRECTOR idler gear to the fully clockwise position until it rests against the stop.

c. Turn the CORRECTOR knob to 135° counterclockwise from the zero position.

d. Tighten the setscrew on the CORRECTOR drive gear.

e. The CORRECTOR knob should turn the same number of degrees on each side of the zero line.

78. RF SET TO LINE Control Adjustment

a. Loosen the setscrews on the RF SET TO LINE shaft coupling.

b. Turn the r-f attenuator shaft so that the outer piston is in the fully closed position; then back off one-half turn.

c. Turn the RF SET TO LINE knob to its clockwise stop.

d. Tighten the coupling setscrews.

79. Replacing Turret Chain

The turret chain drives the turret and switch S2 (fig. 12). The chain may be disassembled by removing the measure link. When it is necessary to replace the chain, it also may be necessary to change the tension on the chain. This is done by changing the position of the chain sprocket gear which is on a common shaft with switch S2. To change the position of the chain sprocket gear, loosen the two screws holding the switch S2 bracket casting and slide the casting up or down to suit the chain tension needs. When the proper tension is achieved, tighten the two casting screws.

80. Setting RF ATTENUATOR MICROVOLTS Stops

a. The RF ATTENUATOR MICROVOLTS stops are located directly behind the front panel. The setting of these stops is not only a mechanical problem but also electrical. Three conditions must be fulfilled when the stops are set properly:

(1) The RF ATTENUATOR MICROVOLTS dial must be set at 10K.

(2) Fifty millivolts output must be produced across the r-f output cable.

(3) The dial stops must be closed as they would be when the flexible coupling is turned fully clockwise.

b. Use the procedure given below to set the stops.

(1) Place the OPERATION switch in the MOD OFF position.

(2) Adjust the RF SET TO LINE control to cause the I. F. MICROVOLTS meter needle to rest on the red line.

(3) Connect a sensitive r-f voltmeter in place of the r-f cable head.

(4) Loosen the setscrews on the front end of the flexible shaft.

(5) Turn the RF ATTENUATOR MICROVOLTS knob to the 10K position.

(6) Loosen the setscrews on the rear of the flexible shaft.

(7) Operate the inner plunger on the attenuator to produce a reading of 50 millivolts on the external meter.

(8) With the RF ATTENUATOR MICROVOLTS knob set at 10K and the attenuator set to provide 50 millivolts at the external meter, turn the flexible coupling in the clockwise position, as viewed from the front of the signal generator, until the dial stop is reached.

(9) Tighten the setscrews on both ends of the flexible shaft.

Section III. ALINEMENT AND ADJUSTMENT PROCEDURES

81. Test Equipment Required for Alinement

a. R-F Frequency Deviation Meter. The frequency deviation meter must have the following:

(1) An input frequency range from 20 to 100 mc.
(2) An input sensitivity of at least 10 millivolts.
(3) An indicator to show true frequency deviation of at least 100 kc.
(4) An overall distortion of less than 1 percent.
(5) A demodulator to permit checking of the audio distortion.

Note. The frequency deviation test set-up consists of the following interconnected units: (1) Audio Oscillator TS–382A/U, (2) Panoramic Indicator IP–173/U, (3) Signal Generator TS–497A/URR, and (4) an f-m receiver with flat frequency response.

b. A-C Electronic Voltmeter. The modulation frequency deviation is determined by the signal amplitude of the audio stages. An electronic-type a-c voltmeter such as Electronic Multimeter ME–6A/U or equivalent is satisfactory for a-f voltage measurements.

c. D-C Milliameter. A d-c milliameter is necessary when setting the current through the voltage regulator tube. It must be capable of indicating currents between 15 and 30 milliamperes accurately. Use Multimeter TS–352/U in this application.

d. R-F Vtvm. The i-f output voltage from the signal generator must be measured when setting the meter calibration for the i-f oscillator section. The voltage to be measured is approximately 1 volt. Use Electronic Multimeter TS–505/U in this application. A low-voltage range should be used.

e. Distortion Analyzer. When distortion measurements are made in the signal generator audio circuits or at the output, an audio distortion meter is necessary. Spectrum Analyzer TS–723/U or equivalent is satisfactory for this purpose.

f. F-M Receiver. Measuring the signal-to noise ratio of the signal generator requires a low noise f-m receiver. The receiver must have a signal-to-noise ratio in the order of 55 to 60 db with respect to 15-kc deviation. This receiver usually is of the battery operated type.

82. Alinement Procedures

a. When any critical r-f or i-f circuits are repaired, it is possible that these repairs might disturb the alinement or adjustment of the circuits. If a circuit is found to need alinement, follow the procedures described in the following paragraphs. Before starting alinement procedures, remove the signal generator from the dust cover. Allow a warm-up period for the test equipment according to the instructions found in the instruction books covering the equipment. The signal generator requires 1½ hours for warm-up.

b. Adjust the coils by turning the slotted brass screws that move the coil cores. Be careful at the extreme limits of these adjustments, as too much pressure may break the screw away from the core and cause a loss of adjustment. Use the sequence indicated for making adjustments of the various circuits. Do not proceed with the next adjustment until satisfactory results are obtained with the step in progress. Refer to figures 41, 42, and 43 for adjustment and alinement locations.

c. Instructions for control settings will be found in the procedure for each adjustment. If possible, the voltage from the power source for the signal generator should be regulated while the alinement adjustments are being made.

83. Regulated B+ Voltage

The regulated B+ voltage (+150 volts) provides for stability of the signal generator; therefore, it is important that this voltage be set correctly before further adjustments are made. This adjustment is made in the following manner:

a. Break the connection from pin 7 on V11 to ground and insert Multimeter TS–352/U across the open circuit.

b. Place the OPERATION switch in the CAL position.

c. Turn the signal generator to the ON position.

d. Adjust R90 to give an indication of 20 milliamperes on the meter. The voltage across V11 should be between +145 and +155 volts.

e. Turn the signal generator to the OFF position.

f. Disconnect the meter and replace the pin 7 connection to ground.

84. Calibration Oscillator Alinement

a. General. Set the calibration oscillator frequency accurately to allow precise settings of the r-f oscillator. Remove the r-f oscillator assembly cover and take the tube shield from V4. Wind 1 or 2 turns of insulated hook-up wire around V4 and connect the free end to a crystal calibrator that has an accuracy of .001 percent. Remove V6 from its socket to prevent unwanted beats. See figure 42 for the location of L1.

b. Procedure.

(1) Place the OPERATION switch in the CAL position.
(2) Set the crystal calibrator to the 1-mc position.
(3) Tune L1 for a zero beat.
(4) Remove the wire from V4 and replace the tube shield.

85. R-F Oscillator Alinement

a. General. There are two methods of checking the frequency accuracy of the r-f oscillator. One method is to use the internal calibration oscillator as a check, and the other is to use an external crystal calibrator or secondary frequency standard. In either method, the CORRECTOR control must be set to the line and left there during the entire procedure. When the first method is used, be sure the internal crystal calibration oscillator has been alined correctly. The adjustment points for the r-f oscillator alinement are shown in figure 42.

b. Alinement, Using External Calibrator. The cores of the r-f turret coils cannot be adjusted unless they are replacement parts which have not been secured to the coil forms by some type of cement. *Do not attempt to adjust cores of the coils in the original turret assembly.*

(1) Connect the r-f output head to the external crystal calibrator.
(2) Place the OPERATION switch in the MOD OFF position.
(3) Turn the RF ATTENUATOR MICROVOLTS control to get full output from the signal generator.
(4) Set the CORRECTOR control to the line.
(5) Turn the BAND SWITCH to band B.
(6) Set the RF TUNING dial to indicate exactly 30 mc.
(7) Adjust trimmer capacitor C25 to obtain a zero beat with the marker signal which indicates 39 mc at the crystal calibrator.
(8) The low ends of each band are adjusted by cores in each turret coil. When a turret coil is in operation, the core cannot be reached. It is, therefore, necessary to check the frequency. After the frequency is checked, move the turret to a position where the core can be turned. Then turn the turret back to the operatting position and check again. Continue this procedure until the coil is tuned to the correct frequency. When adjusting the r-f turret for the lower ends of each band, use the following chart:

Band switch	Frequency (mc)	Adjust core
A	20	L10
B	27	L11
C	38	L12
D	47	L13
E	67	L14

c. Alinement, Using Internal Calibrator. In general, the r-f alinement is accomplished in the same manner when using the internal crystal calibrator as was described in *b* above, with the following exceptions:

(1) The OPERATION switch is placed in the CAL position instead of the MOD OFF position.
(2) The r-f output does not have to be connected to an external unit.
(3) The indication of zero beat is heard on the panel speaker.

86. R-F Output Adjustment

a. When the r-f attenuator is set to 10K (10,000 μv), the output voltage at the end of the r-f-cable without the cable head must be 50 millivolts. When setting the r-f oscillator output for the 50-millivolt potential, three conditions must be fulfilled: the r-f attenuator (RF ATTENUATOR MICROVOLTS) must be exactly 10K; the RF SET TO LINE meter must be set to the line; and there must be 50 millivolts across the output cable with the r-f cable head disconnected. Use the following procedure:

(1) Loosen the screws on the attenuator end of the RF ATTENUATOR MICROVOLTS flexible coupling.
(2) Check to see that the RF ATTENUATOR MICROVOLTS dial is set to 10K.

(3) Move the inner attenuator piston by hand until an output of 50 millivolts is indicated on the meter. When this condition is approached, the inner piston should project approximately ⅛ inch from the end of the attenuator.

(4) When the 50-millivolt output is obtained, tighten the setscrews on the flexible shaft coupling.

(5) If the 50-millivolt output cannot be obtained by movement of the inner attenuator piston, troubleshooting of the r-f oscillator circuit is necessary.

b. Adjust the r-f output meter in the following manner:

(1) Loosen the locknut on potentiometer R69.

(2) Adjust R69 so that the needle of the r-f output is set to the red line when the conditions listed in *a* above are fulfilled.

(3) Tighten the locknut on R69 without disturbing the adjustment.

87. Deviation Level and Distortion Adjustments

a. The signal generator when frequency-modulated must have a calibrated frequency deviation and a minimum of distortion. Most of the distortion that occurs in the f-m originates in the audio oscillator or amplifier stages because of improper amplitude settings. The portion of the characteristic curve at which modulator V5 is operated also is a deciding factor in the amplitude of the modulating signal and in part determines the amount of distortion in the output signal. Both the distortion and deviation level adjustments must be made at the same time. This is accomplished in the following manner:

(1) Place the OPERATION switch in the 1000 ~ position.

(2) Connect a sensitive a-c vtvm such as Electronic Multimeter ME–6A/U at the output of V9.

(3) Set the DEVIATION LEVEL control to the maximum clockwise position.

(4) Loosen the locknut on potentiometer R43 and adjust R43 to give a meter indication of 9 volts.

(5) Replace the a-c vtvm with an audio distortion meter such as Spectrum Analyzer TS–723/U.

(6) Check to see that the distortion is not more than 5 percent. If a higher distortion is present, check the audio circuits of V7, V8, and V9.

(7) Connect an external frequency deviation meter (one which gives the true deviation of an f-m signal and has a deviation range of at least 100 kc and an accuracy of 5 percent or better) to the r-f output head.

(8) Connect the distortion meter across the audio output of the deviation meter.

(9) Place the BAND SWITCH in band A position.

(10) Set the RF TUNING control to approximately the center frequency of band A.

(11) Set the r-f input of the frequency deviation meter to the same setting as the signal generator dial.

(12) Turn the DEVIATION RANGE switch to 50.

(13) Adjust the DEVIATION LEVEL control to give an a-f voltage reading of 8 volts between ground and the junction of resistors R56 and R57.

(14) Adjust potentiometer R57 to cause the deviation meter to read full scale.

(15) Adjust potentiometer R23 for a minimum distortion reading.

(16) Adjust potentiometer R58 to give a true frequency deviation of 50 kc at the external frequency deviation meter.

(17) Repeat the steps in (15) and (16) above as many times as necessary to obtain the 50-kc deviation and the lowest distortion at the same time.

b. Repeat the steps in (9) through (17) above for each band; use the following chart as a guide for locating the adjustments and setting the controls (figs. 41 and 42).

Band	Frequency (mc)	Deviation range set to (kc)	Deviation frequency (kc)	Adjust
A	25	50	50	R58
B	34	50	50	R59
C	45	50	50	R60
D	55	100	100	R61
E	84	100	100	R62

88. Minimum Noise Adjustments

a. This adjustment balances the residual hum in the modulator tube and therefore, is necessary

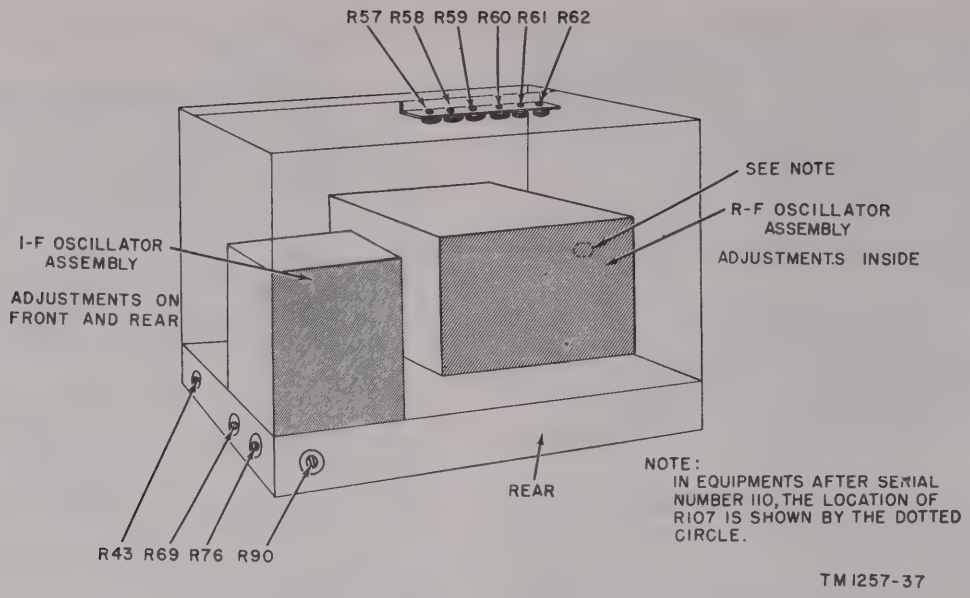

R57 R58 R59 R60 R61 R62
SEE NOTE
R-F OSCILLATOR ASSEMBLY
ADJUSTMENTS INSIDE
I-F OSCILLATOR ASSEMBLY
ADJUSTMENTS ON FRONT AND REAR
REAR
R43 R69 R76 R90
NOTE:
IN EQUIPMENTS AFTER SERIAL NUMBER 110, THE LOCATION OF R107 IS SHOWN BY THE DOTTED CIRCLE.
TM1257-37

Figure 41. Signal Generator SG–12/U, alinement points.

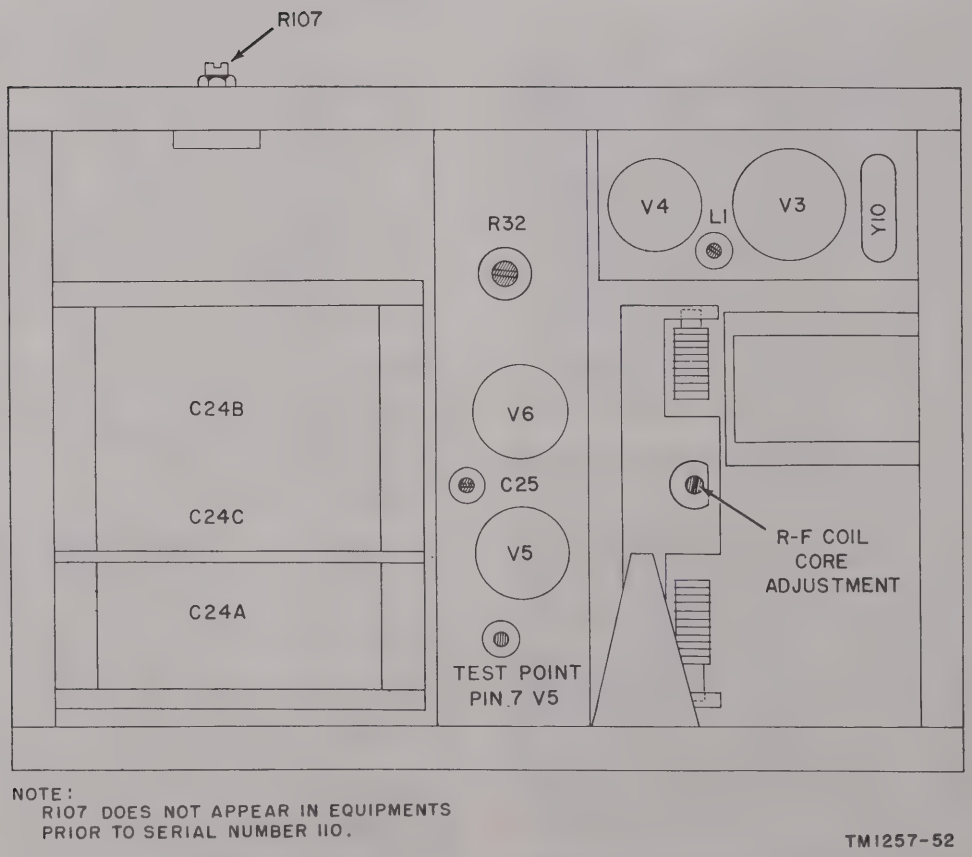


Figure 42. R-f and crystal calibrator, alinement points.

to provide a low noise signal generator output. A low noise f-m receiver and vtvm are used for the measurement to indicate the minimum noise. The f-m receiver must have a signal-to-noise ratio in the order of 55 to 60 db with respect to 15-kc deviation.

b. Refer to figures 41 and 42 for the location of potentiometer R107. Use the following procedure for adjustment of potentiometer R107.

(1) Connect the r-f output cable to the low noise f-m receiver antenna terminals. Connect a sensitive a-c vtvm across the audio output of the f-m receiver. This vtvm should be Electronic Multimeter ME–6A/U or its equivalent.
(2) Place the OPERATION switch in the 1000 ~ position.
(3) Set the RF TUNING and BAND SWITCH to provide a frequency which can be tuned by the f-m receiver.
(4) Tune the receiver to the signal generator frequency. Set the RF ATTENUATOR MICROVOLTS control to a level which will saturate the receiver limiter. At this point the receiver speaker will become quiet.
(5) Set the DEVIATION RANGE switch to 25 kc.
(6) Adjust the DEVIATION LEVEL control to make the meter indicate 15 kc.
(7) Note the output of the receiver on the vtvm.
(8) Switch the OPERATION switch to MOD OFF.
(9) Adjust potentiometer R107 for a minimum reading on the external a-c vtvm.
(10) When making the above adjustment it may be necessary to switch the meter to a more sensitive range. The minimum reading with no modulation should be at least 50 db below the reading obtained with the OPERATION switch in the 1000 ~ position.

89. I-F Oscillator Alinement

(fig. 43)

a. Use an external frequency standard, Frequency Calibrator-Meter Set AN/URM–18 or equal, to check the i-f frequency in each position of the IF FREQUENCY MC switch. The parallel resonant circuits in the plate circuit of the i-f oscillator have an effect on the frequency of the i-f oscillator. Therefore, cores of coils L17 through L25 must be adjusted to cause the oscillator to produce the correct frequencies for each position of the IF FREQUENCY MC switch. While the oscillator coils are being alined, the i-f amplifier coils also can be adjusted. This method speeds up the alinement procedure and also prevents any interaction of controls from upsetting the alinement. Use the following procedure:

(1) Set the OPERATION switch to the IF position.
(2) Set the IF FREQUENCY MC switch to the first frequency (1.4) position.
(3) Adjust the IF LEVEL control to give approximately half-scale deflection on the IF MICROVOLTS meter.
(4) Adjust the core of the oscillator coil for the frequency selected by the IF FREQUENCY MC switch for a zero beat with the external frequency meter.
(5) Adjust the corresponding i-f amplifier coil for a maximum indication on the IF MICROVOLTS meter.

b. Use the following chart to accomplish the adjustments outlined in *a*(4) and (5) above.

IF FREQUENCY MC	Adjust oscillator coil	Adjust amplifier coil
1. 4	L21	L30
2. 515	L20	L29
2. 65	L19	L28
2. 88	L18	L27
4. 3	L17	L26
4. 45	L22	L31
5. 00	L23	L32
5. 35	L24	L33
15. 0	L25	L34

Note. Repeat the steps in *a*(4) and (5) above as many times as necessary to obtain maximum output and a correct frequency at the same time for each position of the IF FREQUENCY MC switch.

90. Adjustment of I-F Output and IF MICROVOLTS Meter

a. Connect an r-f vtvm or a d-c vtvm with an r-f probe across the output terminals of the i-f output cable. Use a low-voltage range (approximately 2 to 5 volts) on the meter.

b. To adjust the i-f output, proceed as follows:

(1) Set the OPERATION switch to the IF position.
(2) Place the IF MICROVOLTS switch in the 1.0 VOLT position.

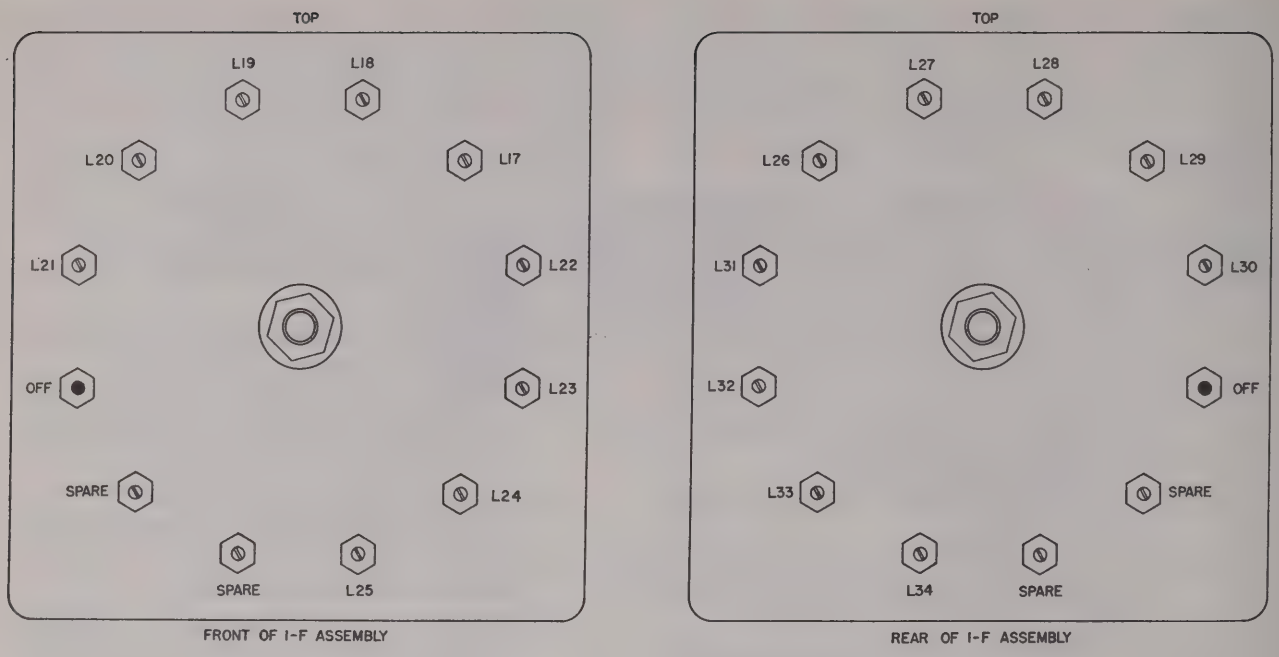


Figure 43. I-f oscillator and amplifier, alinement points.

(3) Adjust the IF LEVEL control to produce a 1-volt indication on the external r-f meter.

(4) Adjust potentiometer R70 to give an indication of 1 volt on the IF MICROVOLTS meter.

Section IV. FINAL TESTING

91. General

This section is a guide to be used in determining the performance of a repaired Signal Generator SG–12/U. The minimum test requirements are given as standards which allow the performance of the generator to be evaluated. Since this instrument is used to test other pieces of equipment, the tolerances are much smaller than those found in ordinary radio equipment. This means that special testing equipment must be used in the procedures outlined in the following paragraphs. If the signal generator meets the requirements given in this section, it will operate satisfactorily when used for checking other equipment.

92. Test Equipment Required for Final Testing

The instruments needed for testing the repaired equipment are listed below, and are listed by nomenclature in paragraph 62.

a. A-C Electronic Voltmeter. It is necessary to measure audio voltages in the signal generator while setting the modulation levels. An a-c vtvm is necessary to provide accurate measurements. Electronic Multimeter ME–6A/U or equivalent is satisfactory for these measurements.

b. Crystal Calibrator. The accuracy of the internal crystal calibrator must be checked by a secondary frequency standard such as Frequency Calibrator-Meter Set AN/URM–18.

c. D-c Milliammeter. A d-c milliammeter with a range from 0 to 50 milliamperes or 0 to 100 milliamperes is used for measuring the current through the power supply voltage regulator tube (par. 94).

d. Frequency Deviation Meter. The external frequency deviation meter must have an input frequency range from 20 to 100 mc. The distortion should be less than 1 percent. The meter should be capable of operating with an input signal of 10 millivolts or less. The true deviations indicated should be 50 kc from 20 to 56 mc and 100 kc from 56 to 100 mc.

e. R-F Output Meter. The r-f output meter must be sensitive enough to measure voltages accurately in the range of 25 to 100 millivolts.

The frequency range of the meter must be between 20 and 100 mc. The impedance should match the 50-ohm output of the r-f cable.

f. R-F Voltmeter. When setting the output level of the i-f amplifier to the i-f attenuator, a specific voltage is to be obtained to provide attenuator accuracy. The r-f to be measured is in the range from 1.0 to 20 mc. This range can be checked with an ordinary d-c vtvm with an r-f probe. The voltage is about 1 volt; therefore, a low range should be used.

93. Test Conditions

a. There are no settings of the controls which will hold for all conditions of test. Each test requires a different sequence of adjustment in the use of different controls. When preparing for final testing, the test equipment and the signal generator should be warmed up for approximately 1½ hours to stabilize the instruments.

b. Check the signal generator under the following conditions:

(1) Line voltage must be either 115 or 230 volts at a frequency between 50 and 1,000 cps.

(2) No adjustments will be made unless the circuit does not perform according to the minimum requirements. If necessary, adjustments will be made in conformance with the alinement procedures in this chapter.

94. Regulated B+ Test

a. Connect a d-c milliammeter in series with the jumper from pin 7 of tube V11 to ground and place a d-c voltmeter across voltage regulator tube V11.

b. Turn on the signal generator and place the OPERATION switch in the CAL position.

c. Check for a milliammeter reading of 20 milliamperes and a voltage reading of 150 volts.

d. The current should be within 5 milliamperes of 20 milliamperes, and the voltage shall be within ±5 volts of +150 volts.

95. Crystal Calibration Oscillator Frequency Test

a. A small amount of output from the calibration amplifier is fed to an external secondary frequency standard by means of a wire wrapped directly around calibration oscillator tube V4.

b. Remove r-f oscillator tube V6 to prevent unwanted beat frequencies.

c. Place the OPERATION switch in the CAL position.

d. Check the 2-mc crystal calibration oscillator frequency against the secondary frequency standard.

e. The 2-mc crystal calibration oscillator frequency should be within 100 cycles of 2 mc.

96. R-F Oscillator Frequency Test

a. Set the OPERATION switch to the MOD OFF position.

b. Set the CORRECTOR control to the line.

c. Connect a 1- to 10-mc crystal calibrator to the r-f cable head.

d. Turn the RF ATTENUATOR MICROVOLTS control to 10K.

e. Adjust the RF SET TO LINE control so that the meter is set to the line.

f. Check three frequencies of each band against the crystal calibrator. These three frequencies should be at the low, the midfrequency, and the high end of each band.

g. Each frequency should be within the tolerances below:

(1) Direct reading, .5 percent.

(2) Indirect frequency setting, .03 percent.

97. R-F Output Test

a. Remove the r-f cable head and in its place connect a sensitive r-f output voltmeter that can measure voltages below 25 millivolts in a frequency range from 20 to 100 mc.

b. Place the OPERATION switch in the MOD OFF position.

c. Set the RF ATTENUATOR MICROVOLTS control to 10K.

d. Adjust the RF SET TO LINE control so that the meter needle rests on the red line.

e. Check the voltage reading on the external voltmeter.

f. With the controls set as outlined in *b* through *e* above, the output voltage should be 50 millivolts.

g. If 50 millivolts cannot be obtained by turning the RF SET TO LINE control clockwise, troubleshooting is necessary.

98. Deviation Accuracy Test

The equipment required for measuring the deviation accuracy of the SG–12/U consists of a Signal Generator SG–42/URM–18, and Oscilloscope OS–16/URM–18 (both part of Frequency Calibrator-Meter Set AN/URM–18), and Audio Oscillator TS–382A/U, a Signal Generator TS–497/

URR, and a Panoramic Indicator IP–173/U. The SG–42/URM–18 and the OS–16/URM–18 are used to set the output frequency of Audio Oscillator TS–382A/U with great accuracy by means of Lissajous patterns. Testing of the deviation accuracy of the SG–12/U depends on the fact that, with a constant modulating frequency, the center frequency of an f-m wave disappears at certain definite values of deviation. The following procedure is used:

a. Testing of 15-kc Deviation Point.

(1) Set up equipment as indicated in the block diagram (fig. 44).

(2) Set SG–12/U to the desired band and r-f frequency.

(3) Set the TS–497/URR to an unmodulated frequency 5 mc below that of (2) above.

(4) Adjust the centering and amplitude of the pip on the IP–173/U scope by varying the frequency and signal output of the TS–497/URR, respectively.

(5) Set the SG–12/U OPERATION switch to the EXT MOD position, the DEVIATION RANGE switch to 25, and the DEVIATION LEVEL fully clockwise.

(6) Set the TS–382A/U, by means of the SG–42/URM–18 and Lissajous patterns, to 6,250 cps.

(7) Adjust the output of the TS–382A/U for full-scale deviation indication on the KILOCYCLES DEVIATION meter on the SG–12/U.

(8) Turn the DEVIATION LEVEL control fully counterclockwise; then turn it clockwise slowly until the carrier pip on the IP–173/U disappears completely (indicating a carrier null) for the first time. The point at which the pip disappears for the first time corresponds to exactly 15-kc deviation. At this point the KILOCYCLES DEVIATION meter should, if properly calibrated, indicate a 15-kc deviation.

b. Testing of 40-kc Deviation Point. The procedure followed is the same as that described in *a* above except for the following:

(1) Set the TS–382A/U to 4,640 cps.

(2) Set the DEVIATION RANGE switch to 50.

(3) The 40-kc deviation point corresponds exactly to the point where the carrier pip disappears completely for the third time. At this point, the KILOCYCLES DEVIATION meter should indicate 40-kc deviation.

c. Testing of 75-kc Deviation Point. The procedure followed is the same as that described in *a* above, except for the following:

(1) Set the TS–382A/U to 3,537 cps.

(2) Set the DEVIATION RANGE switch to 100.

(3) The 75-kc deviation point corresponds exactly to the point where the carrier pip disappears completely for the seventh time. At this point, the KILOCYCLES DEVIATION meter should indicate a 75-kc deviation.

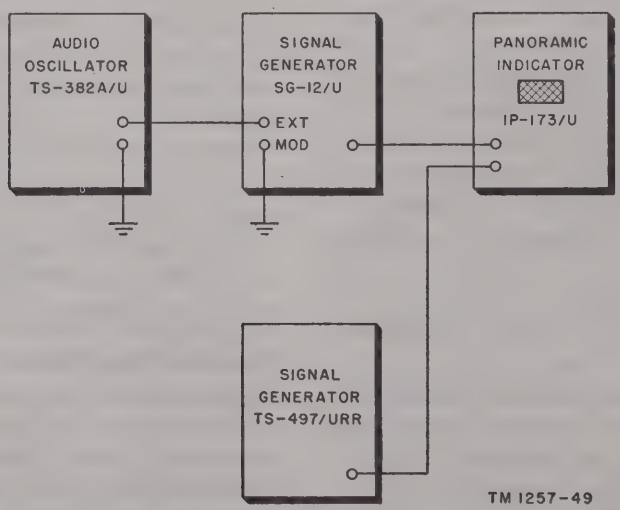


Figure 44. Deviation accuracy test set-up.

d. Summary. The following table summarizes the preceding settings.

Deviation (kc)	Ext mod freq (cps)	Carrier null
15	6250	1st
40	4640	3d
75	3537	7th

99. Modulation Distortion Test

a. The equipment required for measuring the modulation distortion in the f-m output of the SG–12/U consists of Spectrum Analyzer TS–723/U; Electronic Multimeter ME–6A/U; and an f-m receiver having an r-f range of 20 to 100 mc, a minimum bandwidth of 100 kc, and a discriminator with a linear range from —100 kc to +100 kc. The ME–6A/U in this instance is used as an audio amplifier.

b. The procedure for the test is as follows:

(1) Connect the equipment as shown in the block diagram (fig. 45).

(2) Set the SG–12/U to the desired r-f frequency and deviation.

(3) If the output of the discriminator of the f-m receiver is less than the 1 volt required to drive Spectrum Analyzer T–S 723/U, the ME–6A/U may be used as a low distortion amplifier as shown in the solid line connections on the block diagram.

(4) Measure the distortion.

(5) The distortion should be less than 5 percent.

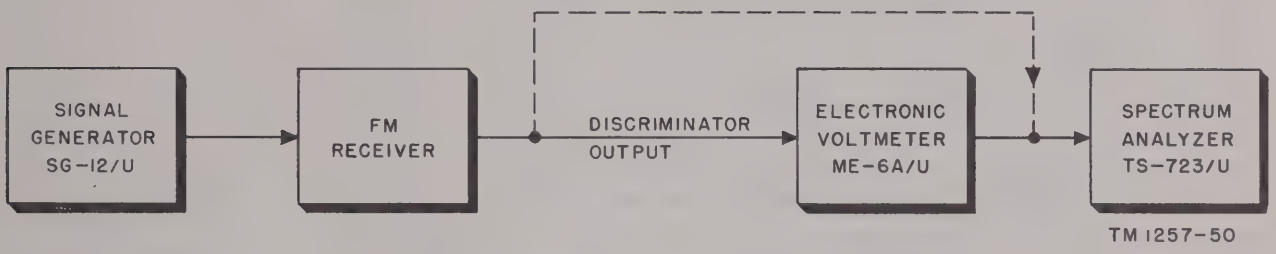


Figure 45. Modulation distortion test set-up.

100. Noise Test

a. To make the noise test, it is necessary to use a low noise f-m receiver and a sensitive a-c vtvm such as Electronic Multimeter ME–6A/U. The receiver need not cover all the r-f frequencies of the signal generator since the test only has to be made at one frequency which may be chosen at random.

b. Use the following procedure for the test:

(1) Connect the r-f output cable of the signal generator to the receiver antenna terminals. Connect a sensitive a-c vtvm across the audio output of the receiver.

(2) Place the OPERATION switch in the 1000 ~ position.

(3) Set the RF TUNING and BAND SWITCH to provide a frequency which can be tuned by the f-m receiver.

(4) Tune the receiver to the signal generator frequency. Set the RF ATTENUATOR MICROVOLTS control to a level which will saturate the receiver limiter. At this point the receiver speaker will beeomc quiet.

(5) Set the DEVIATION RANGE switch to 25 kc.

(6) Adjust the DEVIATION LEVEL control to make the KILOCYCLES DEVIATION meter indicate 15 kc.

(7) Note the audio output of the receiver.

(8) Switch the OPERATION switch to MOD OFF.

(9) Note the receiver output reading. The difference between the reading with modulation and without modulation should be at least 50 db. If the reading does not meet the minimum requirements it may indicate adjustment of potentiometer R107 is necessary or replacement of tube V5.

101. I-F Oscillator Test

The i-f oscillator is crystal-controlled; however, there are tuned circuits in the oscillator and amplifier stages which have a tendency to change the

frequency of oscillation slightly. Even though the crystal is ground to resonance at the exact frequency, it may be shifted slightly to another frequency when placed in the signal generator. The test requires a secondary standard to measure the frequency difference of the i-f oscillator and the correct frequency which is indicated on the front panel by the IF FREQUENCY MC switch. Measure the output frequency of the i-f oscillator by using Frequency Calibrator-Meter Set AN/URM–18. To be acceptable the frequency as indicated on the front panel must be within .005 percent of that measured by the AN/URM–18.

102. I-F Output Test

This test is to check the i-f amplifier output to the i-f attenuator. If the voltage is not correct to the attenuator, all output voltage calibrations will be incorrect. The output voltage is checked by an r-f voltmeter. The voltage to be checked is 1 volt; therefore, a low range should be used for the measurements.

a. Procedure.

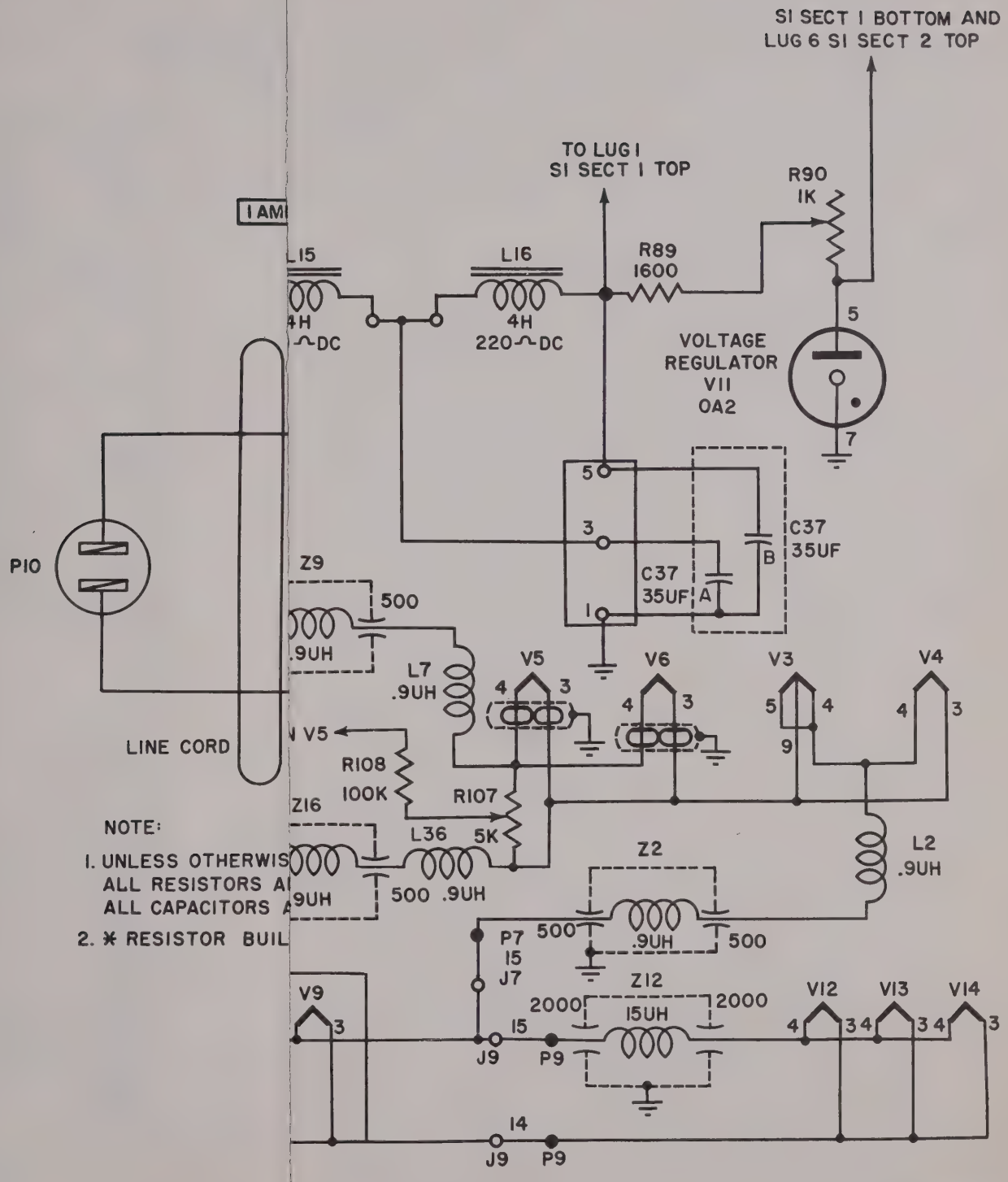
(1) Connect the r-f voltmeter across the i-f output cable head.

(2) Set the OPERATION switch to IF. Set the IF MICROVOLTS switch to the 1.0 VOLT position.

(3) Adjust the IF LEVEL control so that the IF MICROVOLTS meter reads 1 volt.

(4) Check the readings with the above control position for all positions of the IF FREQUENCY MC switch.

b. Minimum Requirements. A reading of 1 volt on the IF MICROVOLTS meter should correspond within ± 10 percent to an external meter reading of 1 volt.


SI SECT I BOTTOM AND
LUG 6 SI SECT 2 TOP
TO LUG I
SI SECT I TOP
R90
IK
R89
1600
L15
4H
DC
L16
4H
220 DC
VOLTAGE
REGULATOR
VII
0A2
5
7
P10
LINE CORD
C37
35UF
B
C37
35UF
A
Z9
500
.9UH
L7
.9UH
V5
V6
V3
V4
R108
100K
R107
5K
Z16
L36
500 .9UH
Z2
L2
.9UH
P7
500
.9UH
500
15
J7
V9
Z12
2000
15UH
2000
V12
V13
V14
15
J9
P9
14
J9
P9
NOTE:
1. UNLESS OTHERWIS
ALL RESISTORS A
ALL CAPACITORS A
2. * RESISTOR BUIL

TM1257-54

frequency of oscillation slightly. Even though the crystal is ground to resonance at the exact frequency, it may be shifted slightly to another frequency when placed in the signal generator. The test requires a secondary standard to measure the frequency difference of the i-f oscillator and the correct frequency which is indicated on the front panel by the IF FREQUENCY MC switch. Measure the output frequency of the i-f oscillator by using Frequency Calibrator-Meter Set AN/URM–18. To be acceptable the frequency as indicated on the front panel must be within .005 percent of that measured by the AN/URM–18.

102. I-F Output Test

This test is to check the i-f amplifier output to the i-f attenuator. If the voltage is not correct to the attenuator, all output voltage calibrations will be incorrect. The output voltage is checked by an r-f voltmeter. The voltage to be checked is 1 volt; therefore, a low range should be used for the measurements.

a. Procedure.

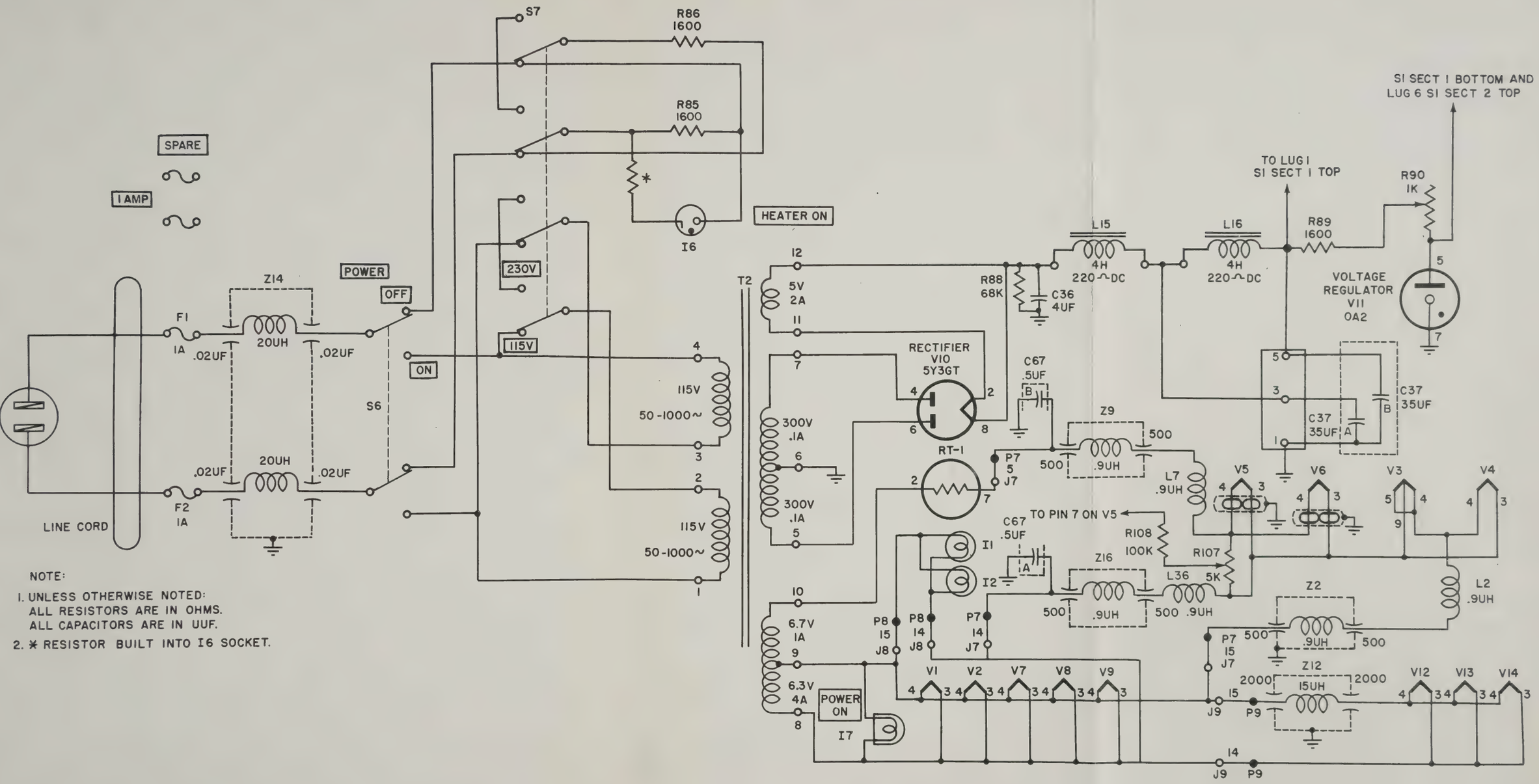
(1) Connect the r-f voltmeter across the i-f output cable head.

(2) Set the OPERATION switch to IF. Set the IF MICROVOLTS switch to the 1.0 VOLT position.

(3) Adjust the IF LEVEL control so that the IF MICROVOLTS meter reads 1 volt.

(4) Check the readings with the above control position for all positions of the IF FREQUENCY MC switch.

b. Minimum Requirements. A reading of 1 volt on the IF MICROVOLTS meter should correspond within ± 10 percent to an external meter reading of 1 volt.



NOTE:

1. UNLESS OTHERWISE NOTED:
   ALL RESISTORS ARE IN OHMS.
   ALL CAPACITORS ARE IN UUF.
2. * RESISTOR BUILT INTO I6 SOCKET.

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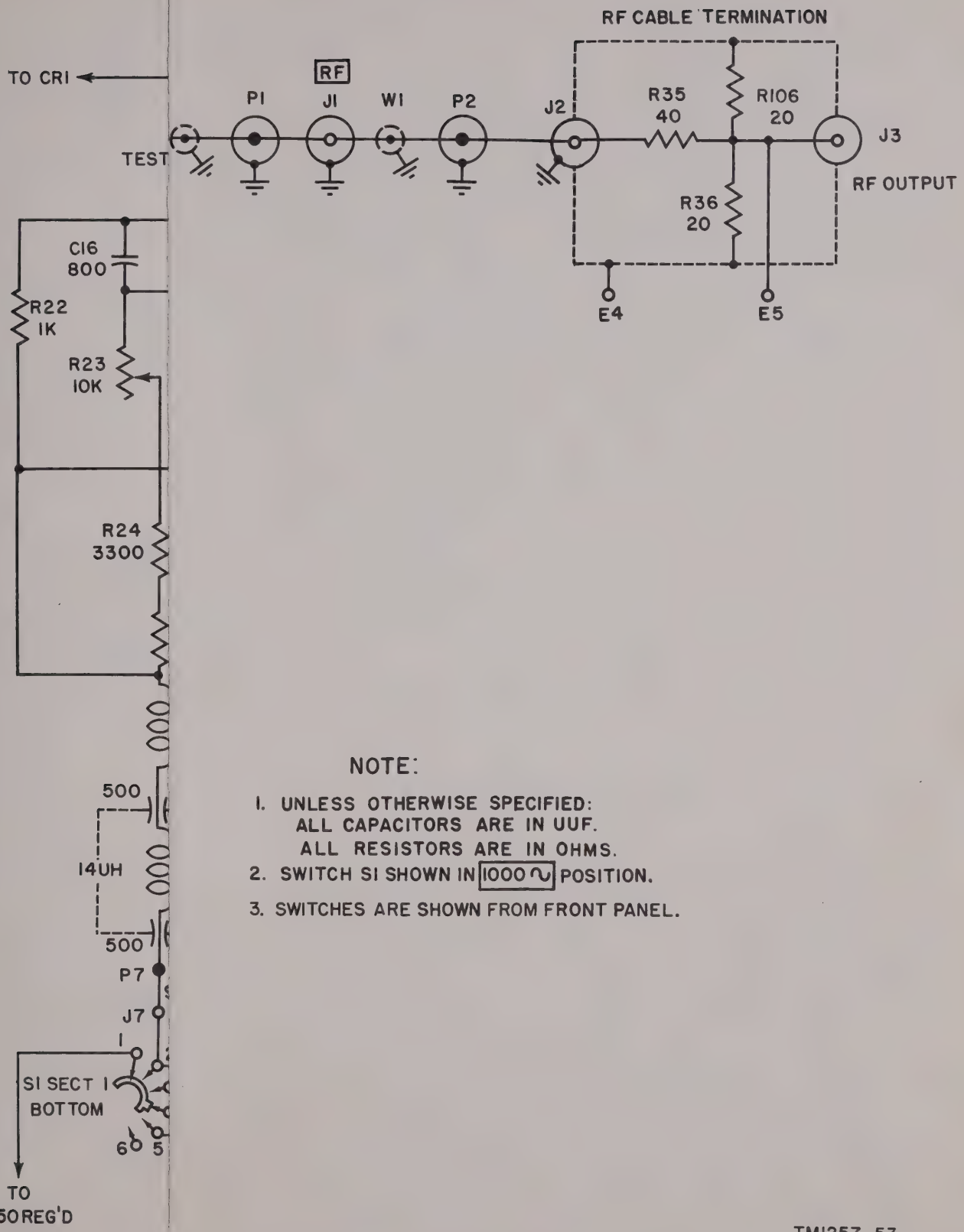
Figure 30. Power supply, simplified schematic diagram (equipments after serial No. 110).



NOTE:

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITORS ARE IN UUF.
   ALL RESISTORS ARE IN OHMS.
2. SWITCH S1 SHOWN IN [1000 ~] POSITION.
3. SWITCHES ARE SHOWN FROM FRONT PANEL.

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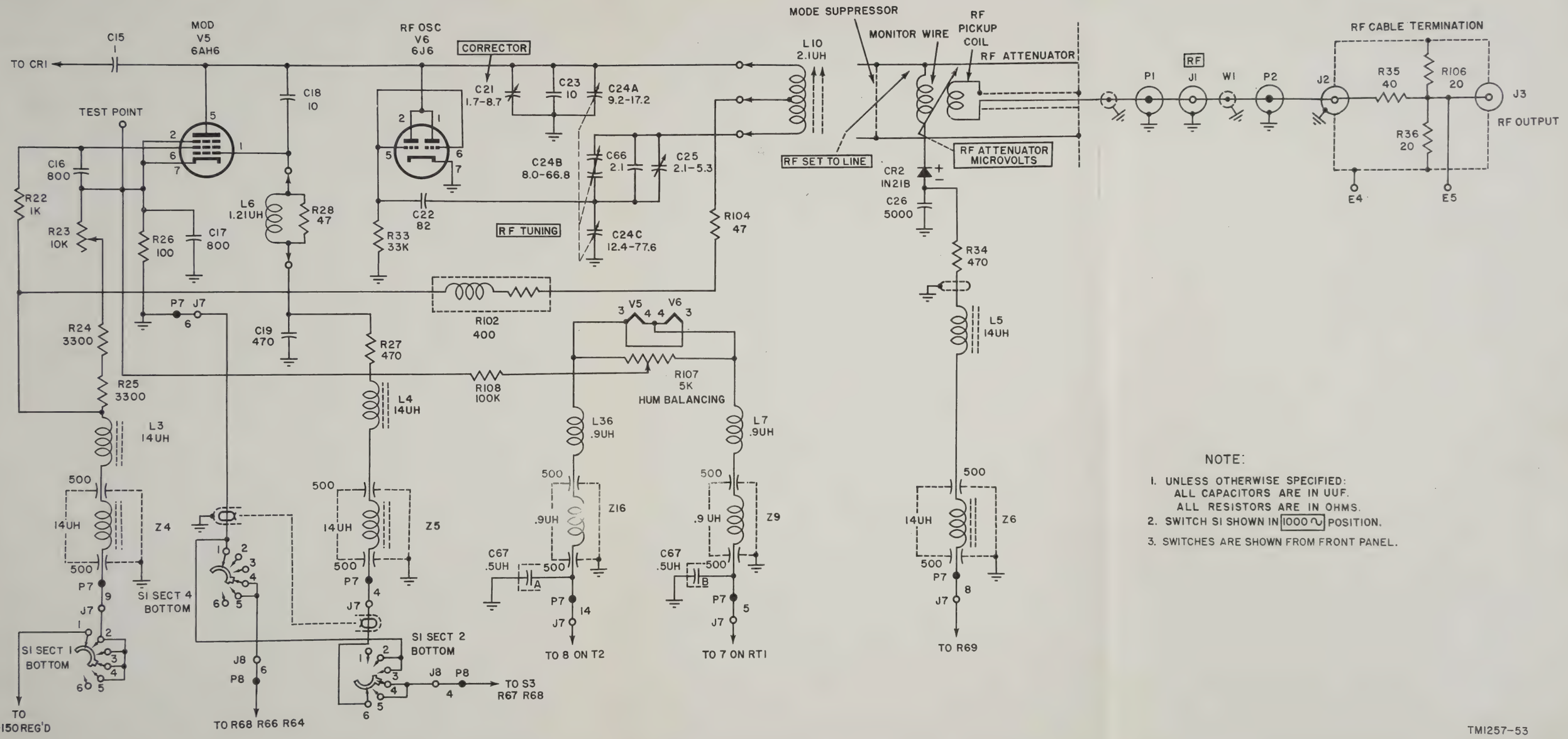
399634 O -56 (Face p. 44)



NOTE:

1. UNLESS OTHERWISE SPECIFIED: ALL CAPACITORS ARE IN UUF. ALL RESISTORS ARE IN OHMS.
2. SWITCH S1 SHOWN IN 1000 ~ POSITION.
3. SWITCHES ARE SHOWN FROM FRONT PANEL.

Figure 19. Modulator and r-f oscillator stages, simplified schematic diagram (equipments after serial number 110)

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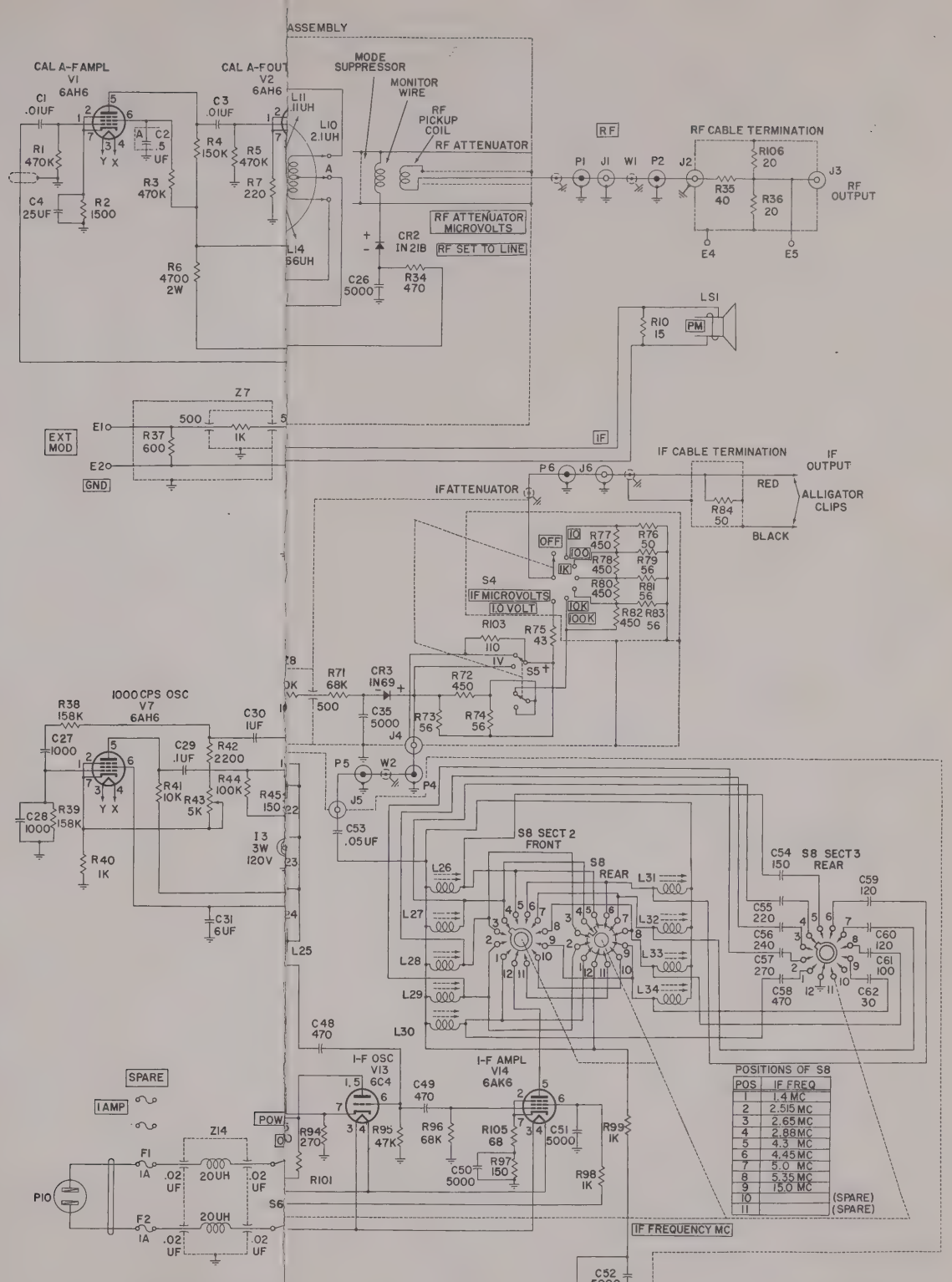

NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, AN ALL CAPACITORS ARE IN UUF.
2. * RESISTOR BUILT INTO LAMP SOCK
3. †S5 IN UNMARKED POSITION FOR AL POSITIONS OF S4 EXCEPT 1.0 VOLT
4. SWITCHES VIEWED FROM FRONT P
5. PLUGS AND JACKS ARE VIEWED F

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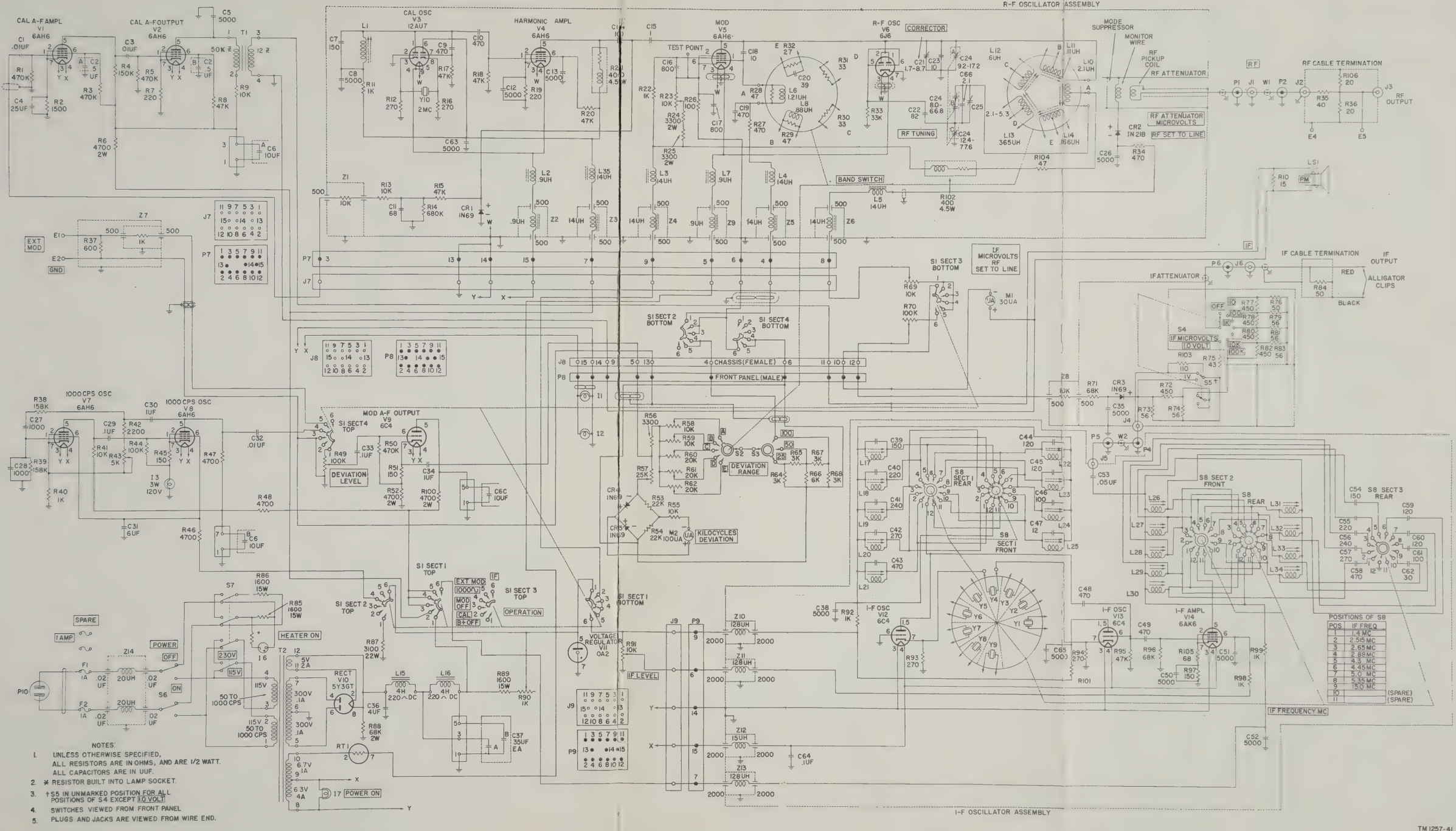

NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, AND ARE 1/2 WATT. ALL CAPACITORS ARE IN UUF.
2. * RESISTOR BUILT INTO LAMP SOCKET.
3. †S5 IN UNMARKED POSITION FOR ALL POSITIONS OF S4 EXCEPT 1.0 VOLT
4. SWITCHES VIEWED FROM FRONT PANEL
5. PLUGS AND JACKS ARE VIEWED FROM WIRE END.

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Figure 48. Signal Generator SG-12/U, schematic diagram for serial numbers below 110. (For serial numbers above 20, see fig. 49 for cathode circuit of V3.)

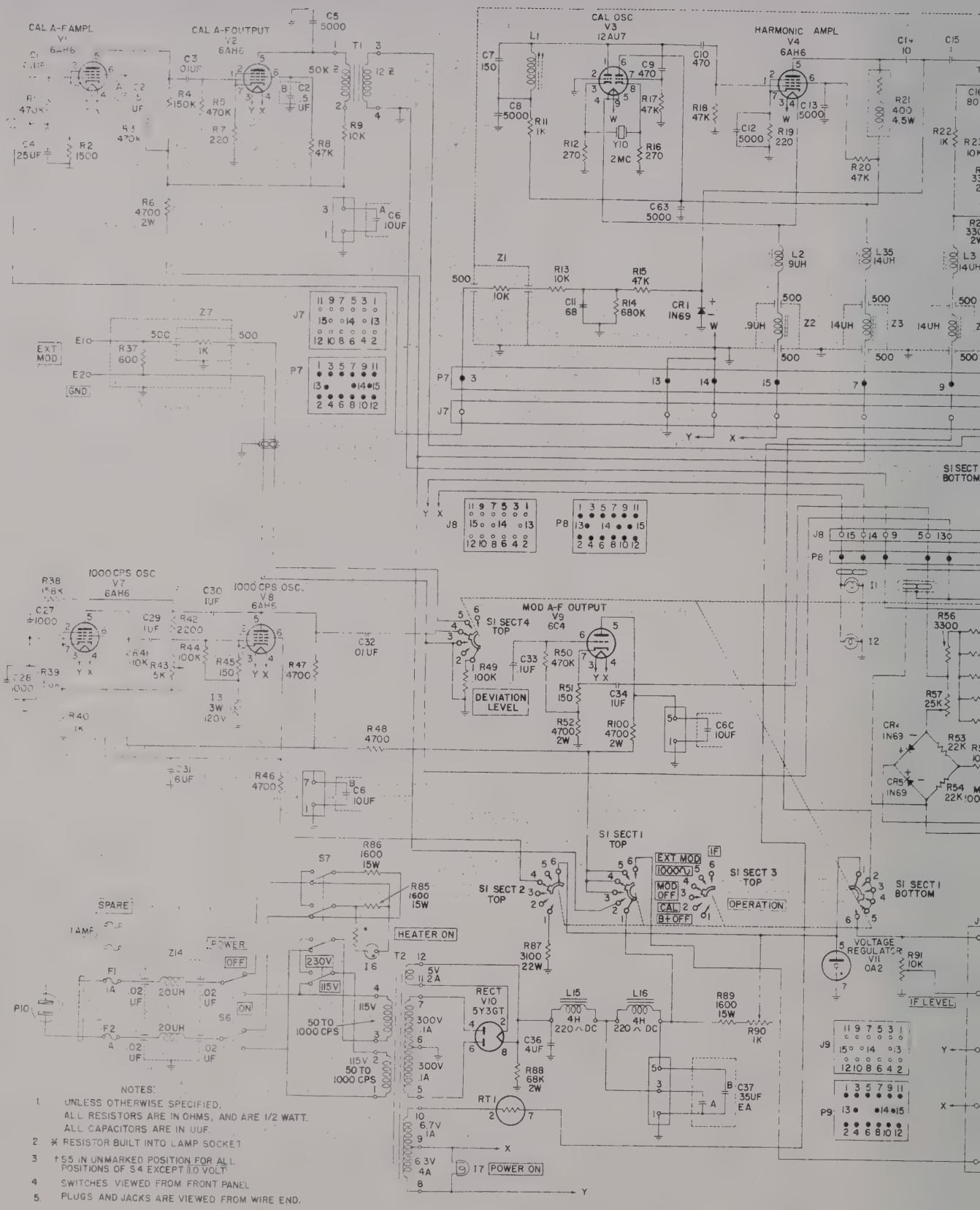
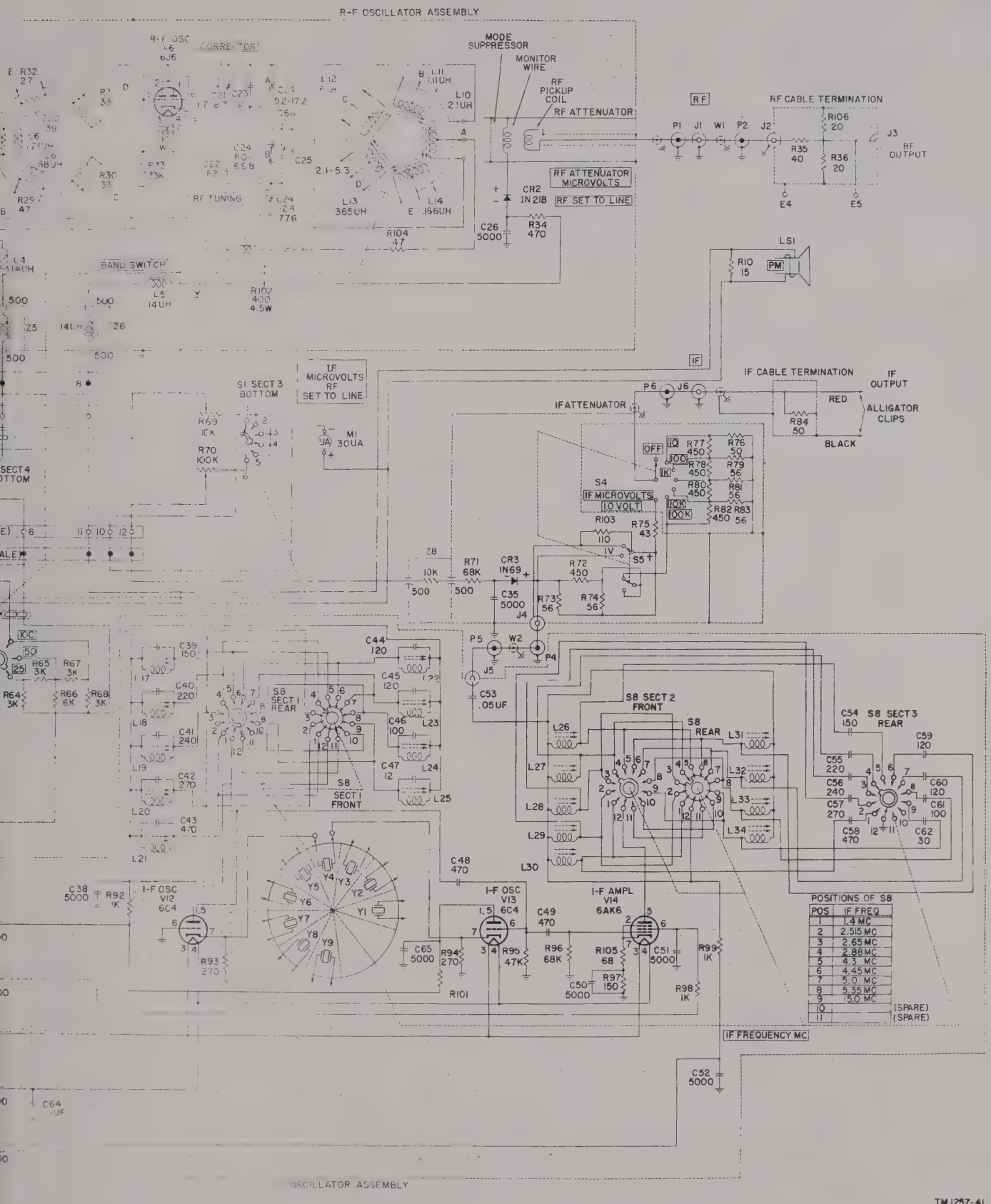


Figure 48. Signal Generator SG–12/U, schematic d
fig. 48



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numbers below 110. (For serial numbers above 20, see t of V3.)

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

103. Repacking for Shipment or Limited Storage

a. The exact procedure used in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. If the original packing materials have been saved or if similar materials are available, refer to paragraph 13 for repacking.

b. Whenever practicable, place a dehydrating agent, such as silica gel, inside the inner carton. Protect the transit case with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected case in a padded wooden case, providing at least 3 inches of excelsior padding between the paper barrier and the packing case.

104. Demolition of Materiel to Prevent Enemy Use

The demolition procedures outlined in paragraph 105 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only on order of the commander.

105. Methods of Destruction

a. Smash. Smash the crystals, controls, tubes, coils, switches, capacitors, and transformers, using sledges, axes, handaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut cords and wiring, using axes, handaxes, or machetes.

c. Burn. Burn cords, resistors, capacitors, coils, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

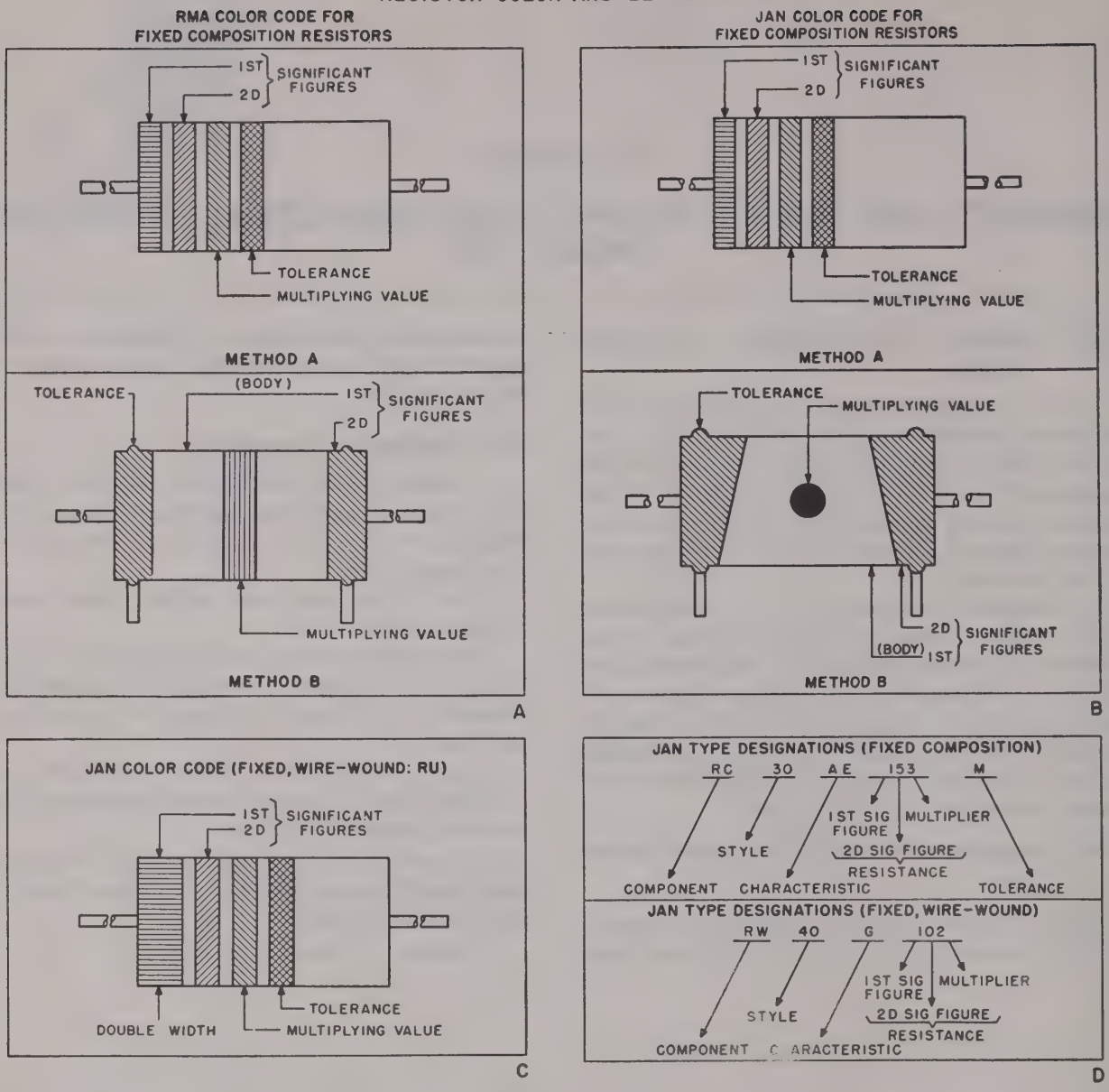
d. Bend. Bend panels, cabinet, and chassis.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy. Destroy everything.

RESISTOR COLOR AND LETTER CODE



STANDARDS				
COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)	JAN LETTER TOLERANCE
BLACK	0	1	–	–
BROWN	1	10	± 1	F
RED	2	100	± 2	G
ORANGE	3	1,000	± 3	–
YELLOW	4	10,000	± 4	–
GREEN	5	100,000	± 5	–
BLUE	6	1,000,000	± 6	–
VIOLET	7	10,000,000	± 7	–
GRAY	8	100,000,000	± 8	–
WHITE	9	1,000,000,000	± 9	–
GOLD	–	0.1	± 5	J
SILVER	–	0.01	±10	K
NO COLOR	–	–	±20	M

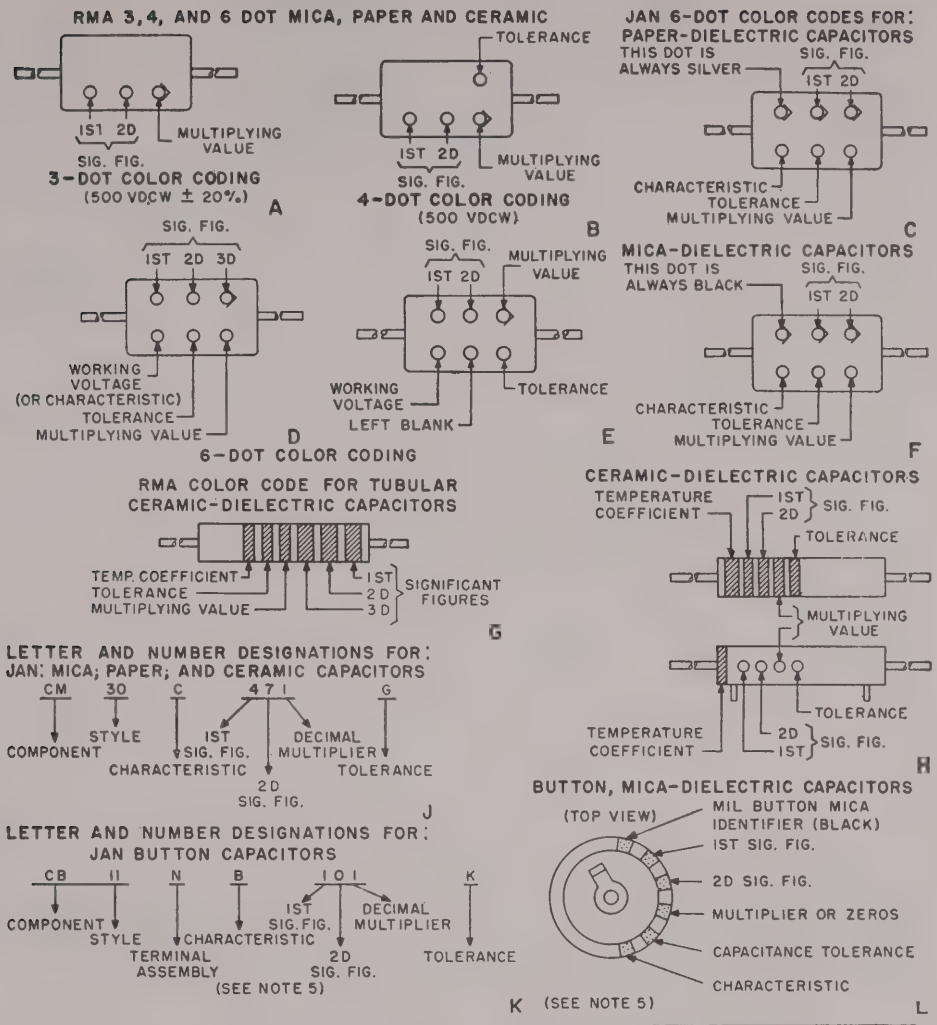
NOTES:

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

Figure 46. Resistor color codes.

CAPACITOR COLOR AND LETTER CODES



- STANDARDS -					JAN MICA-CM		JAN PAPER-CM		JAN CERAMIC-CC					
									CAP. TOL. FOR MORE THAN 10 UUF			CAP. TOL. FOR 10 UUF OR LESS		
COLOR	SIG. FIG.	DECIMAL MULTIPLIER	% TOL.	VDCW	LETTER TOL.	CHARAC-TERISTIC	LETTER TOL.	CHARAC-TERISTIC	DEC. MULT.	%	LETTER DESIG-NATION	UUF	LETTER DESIG-NATION	CHARAC-TERISTIC
BLACK	0	1	±20	500	M	A	M	A	1	±20	M	±2.0	G	C
BROWN	1	10	± 1	100	-	B	-	E	10	± 1	F	-	-	H
RED	2	100	± 2	200	G	C	-	H	100	± 2	G	-	-	L
ORANGE	3	1,000	± 3	300	-	D	N*	J	1,000	-	-	-	-	P
YELLOW	4	10,000	± 4	400	-	E	-	P	-	-	-	-	-	R
GREEN	5	100,000	± 5	500	-	F	-	R	-	± 5	J	±0.5	D	S
BLUE	6	1,000,000	± 6	600	-	G	-	S	-	-	-	-	-	T
VIOLET	7	10,000,000	± 7	700	-	-	-	T	-	-	-	-	-	U
GRAY	8	100,000,000	± 8	800	-	-	-	-	0.01	-	-	±0.25	C	B
WHITE	9	1,000,000,000	± 9	900	-	-	-	-	0.1	± 10	K	±1.0	F	SL
GOLD	-	0.1	± 5	1,000	J	-	-	-	-	-	-	-	-	A
SILVER	-	0.01	±10	2,000	K	-	K	-	-	-	-	-	-	-
NO COLOR	-		±20	500	-	-	-	-	-	-	-	-	-	-

* THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±3%

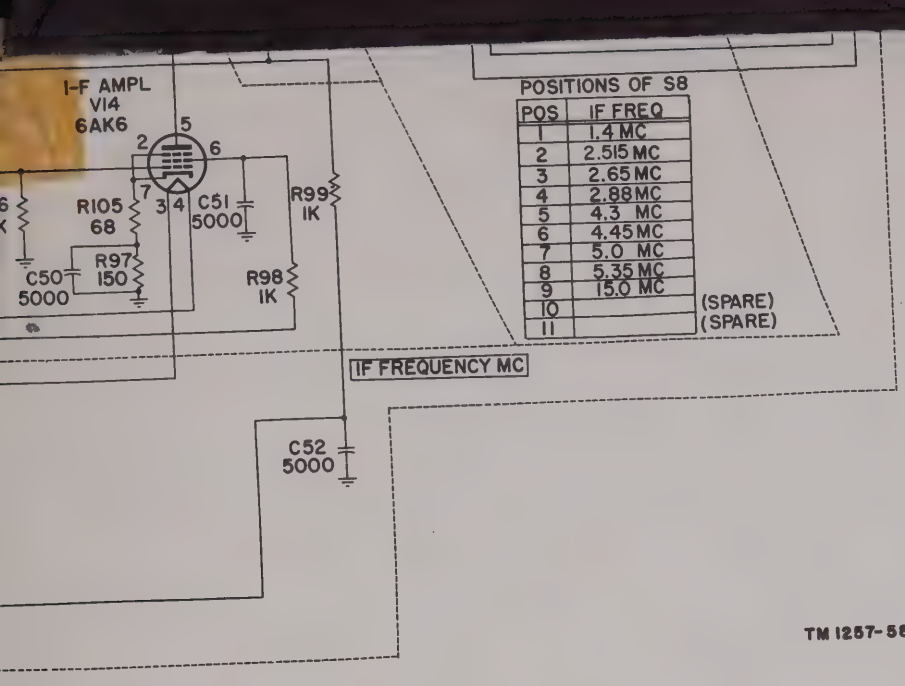
NOTES

JAN: JOINT ARMY-NAVY
RMA: RADIO MANUFACTURERS ASSOCIATION

1. THESE COLOR AND LETTER CODES GIVE CAPACITANCES IN MICROMICROFARADS
2. THIS TABLE IS ADAPTED FOR JAN AND RMA COLOR AND JAN LETTER TYPE DESIGNATIONS
3. CERAMIC AND MICA CAPACITORS, BOTH JAN AND RMA, ARE GENERALLY 500 VDCW
4. BUTTON CAPACITORS ARE GENERALLY 300 VDCW
5. READ BUTTON CAPACITOR TOLERANCE UNDER CERAMICS OF MORE THAN 10 UUF
6. CHARACTERISTICS ARE AVAILABLE IN JAN CAPACITOR SPECIFICATION MANUALS
7. THE COMPONENTS USED ABOVE FOR JAN LETTER TYPE DESIGNATIONS ARE:
   CB MICA BUTTON: *CC* CERAMIC; *CM* MICA MOULDED: *CN* PAPER MOULDED

TM CC

Figure 47. Capacitor color codes.



POSITIONS OF S8

POS	IF FREQ
1	1.4 MC
2	2.515 MC
3	2.65 MC
4	2.88 MC
5	4.3 MC
6	4.45 MC
7	5.0 MC
8	5.35 MC
9	15.0 MC
10	(SPARE)
11	(SPARE)

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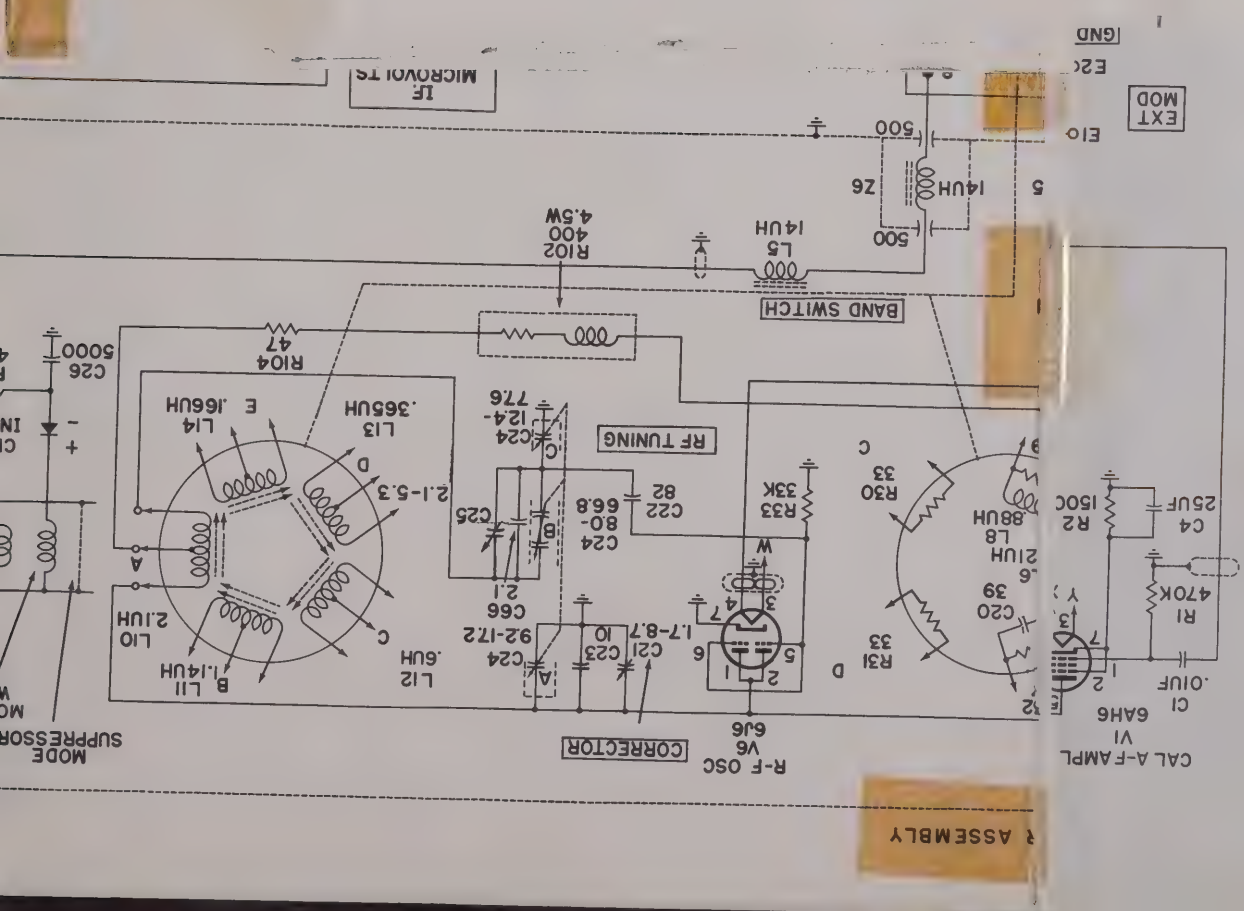
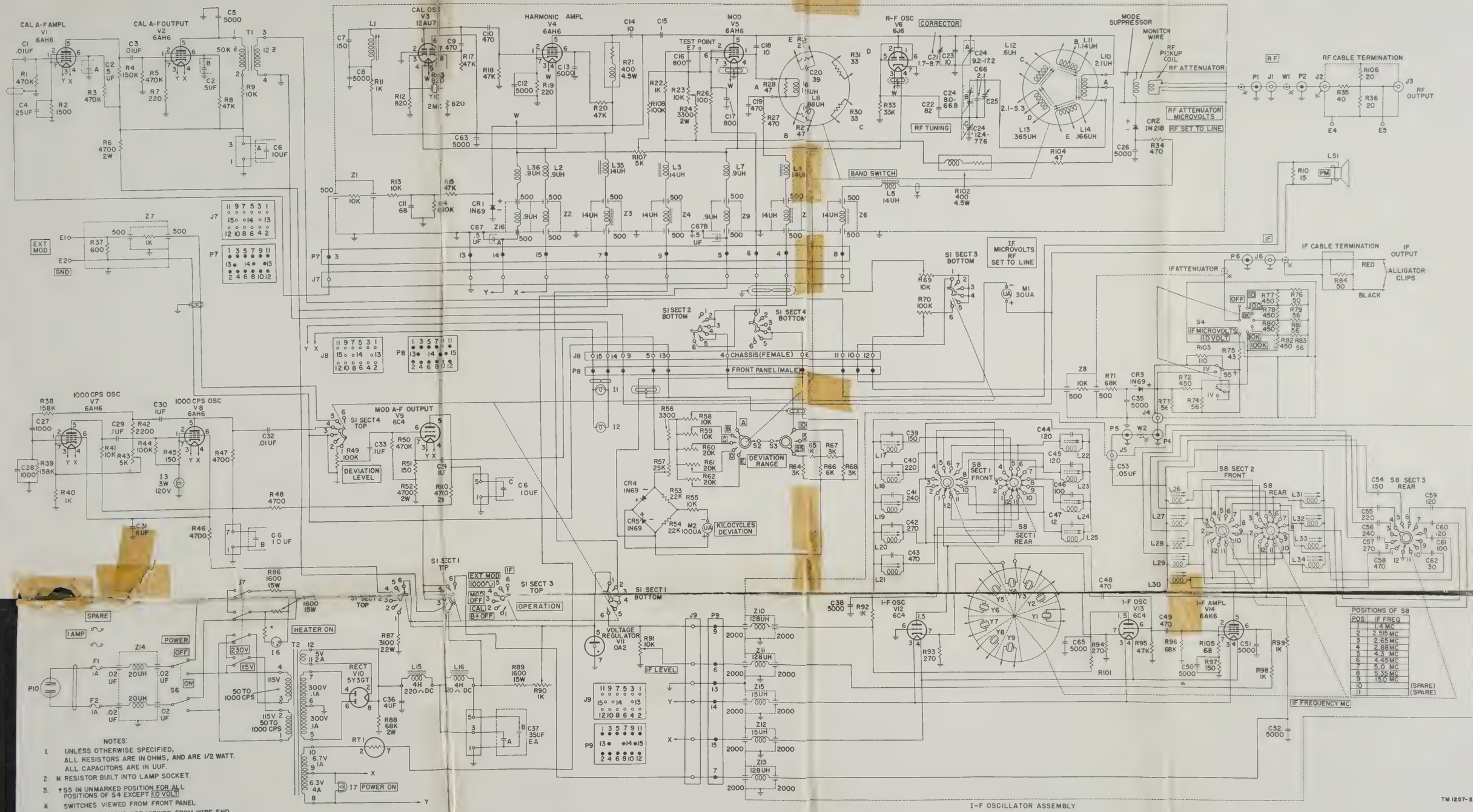
399634 O -56 (Face p. 90) No. 2

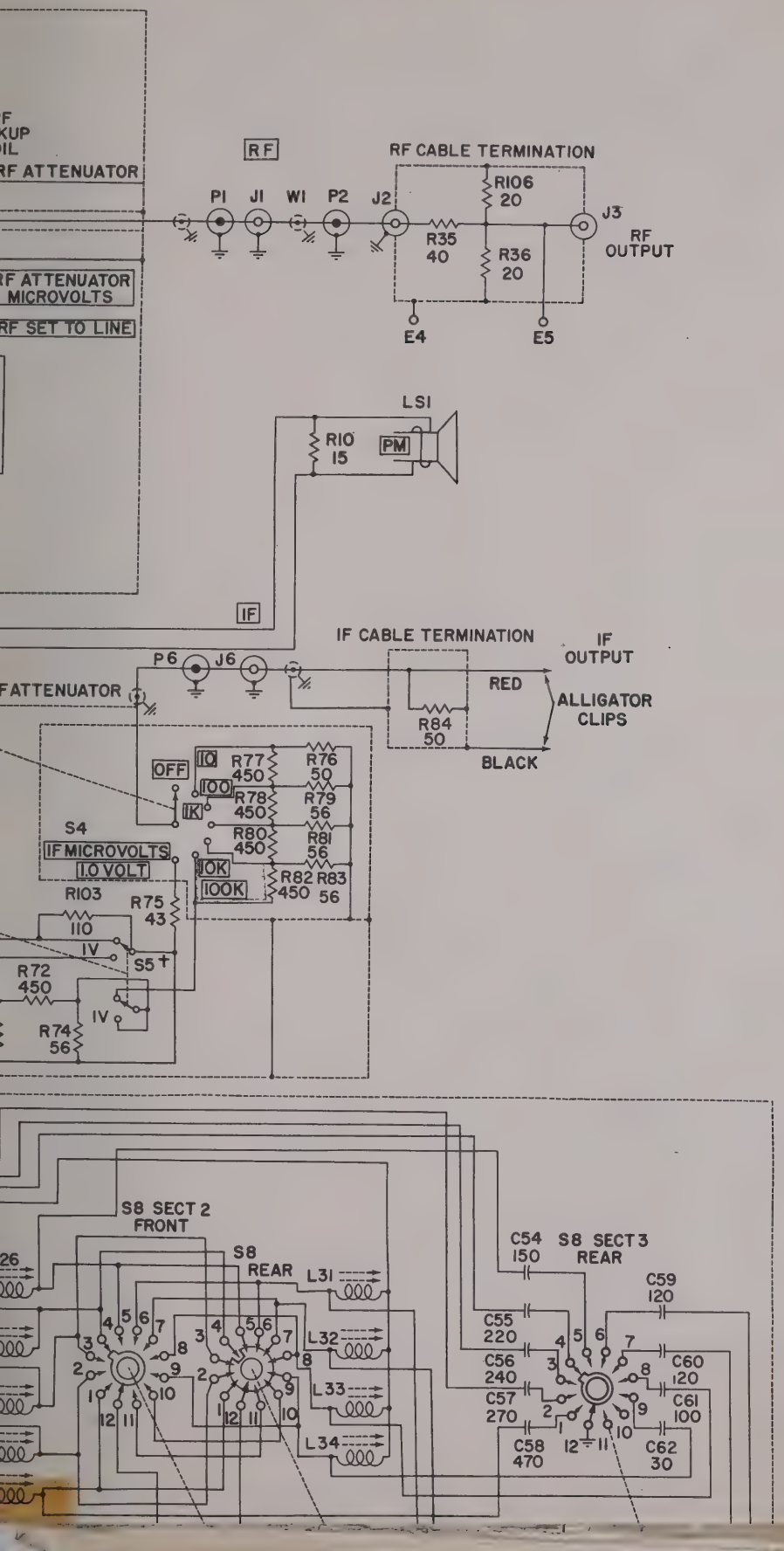




NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, AND ARE 1/2 WATT. ALL CAPACITORS ARE IN UUF.
2. * RESISTOR BUILT INTO LAMP SOCKET.
3. †S5 IN UNMARKED POSITION FOR ALL POSITIONS OF S4 EXCEPT I.0 VOLT.
4. SWITCHES VIEWED FROM FRONT PANEL
5. PLUGS AND JACKS ARE VIEWED FROM WIRE END.

Figure 49. Schematic diagram of Signal Generator SG-12/U (for serial numbers after 110).


RF
RF CABLE TERMINATION
P1 J1 W1 P2 J2
R106 20
R35 40
R36 20
J3
RF OUTPUT
E4
E5
RF ATTENUATOR
RF ATTENUATOR MICROVOLTS
RF SET TO LINE
LS1
R10 15
PM
IF
IF CABLE TERMINATION
P6 J6
IF OUTPUT
RED
ALLIGATOR CLIPS
R84 50
BLACK
OFF
1Ω
100
1K
10K
100K
R77 450
R78 450
R79 56
R80 450
R81 56
R82 450
R83 56
R76 50
S4
IF MICROVOLTS
1.0 VOLT
R103 110
R75 43
IV
S5
R72 450
R74 56
S8 SECT 2 FRONT
S8 REAR
L31
L32
L33
L34
C54 150
S8 SECT 3 REAR
C59 120
C55 220
C56 240
C57 270
C58 470
C60 120
C61 100
C62 30

DEPARTMENT OF THE ARMY TECHNICAL MANUAL
DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

SIGNAL GENERATOR AN/URM–48

TM 11–1257
TO 33A1–8–18–1
CHANGES No. 2

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *2 August 1956*

TM 11–1257/TO 33A1–8–18–1, 8 December 1953, is changed as follows:

Change "Signal Generator SG–12/U" to **Signal Generator SG–12(*)** in the following places in the manual:

Page 7, paragraph 3. Line 1.
Page 7, paragraph 3. Line 13.
Page 9, figure 3. Caption and block.
Page 10, paragraph 8. Heading.
Page 10, paragraph 8*a*. Line 1.
Page 10, paragraph 8*c*. Line 12.
Page 11, paragraph 11. Line 2.
Page 15, figure 5. Caption.
Page 17, figure 6. Caption and callout.
Page 25, paragraph 26. Line 1.
Page 31, figure 13. Caption.
Page 38, paragraph 46. Line 1.
Page 39, figure 16. Caption.
Page 60, paragraph 62. Line 2.
Page 62, figure 31. Caption.
Page 65, figure 32. Caption.
Page 80, figure 41. Caption.
Page 82, paragraph 91. Line 3.
Page 83, paragraph 98. Line 2.
Page 84, paragraph 98. Line 6.
Page 84, paragraph 98*a*(2). Line 1.
Page 84, paragraph 98*a*(5). Line 1.
Page 84, paragraph 98*a*(7). Line 4.
Page 84, figure 44. Block.
Page 85, paragraph 99*a*. Line 3.
Page 85, paragraph 99*b*(2). Line 1.
Page 85, figure 45. Block.

Page 7, paragraph 1. Add the following after the first sentence:

Signal Generator AN/URM–48 consists of Signal Generator SG–12/U or Signal Generator SG–12A/U carried in Signal Generator Case CY–1217/U accompanied by Electrical Dummy Load DA–69/URM–48. Signal Generator SG–12(*) is used to refer to Signal Generator SG–12/U and Signal Generator SG–12A/U.

Page 7, paragraph 1. Delete *a* and *b*.

Page 9, paragraph 5. Delete the information given under "Frequency range:" and substitute the following:

Frequency range:	*SG–12/U*	*SG–12A/U*
Rf:		
Band A	19.5 mc. to 29 mc.	20 mc. to 28 mc.
Band B	26.5 mc. to 39.5 mc.	27 mc. to 39 mc.
Band C	37 mc. to 56 mc.	38 mc. to 55 mc.
Band D	46 mc. to 70 mc.	47 mc. to 69 mc.
Band E	66 mc. to 102 mc.	67 mc. to 102 mc.
If.	1.4 mc.	1.37 mc.
	2.515 mc.	1.40 mc.
	2.65 mc.	1.43 mc.
	2.88 mc.	4.27 mc.
	4.3 mc.	4.30 mc.
	4.45 mc.	4.33 mc.
	5.00 mc.	4.45 mc.
	5.35 mc.	5.00 mc.
	15.0 mc.	5.35 mc.
	Two spare positions for future use.	15.00 mc.
		One spare position for future use.

Page 9, paragraph 5. Delete "Weight" and the associated information and substitute the following:

Weight:	*Signal Generator SG–12/U*	*Signal Generator SG–12A/U*
In dust cover only	72 lbs	65 lbs
In transit case	104 lbs	97 lbs

Page 10, paragraph 7. Delete the table of components and substitute the following:

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu. ft.)	Unit weight (lb.)
Signal Generator SG–12/U	1	12	12	18	1.5	72
or						
Signal Generator SG–12A/U	1	13½	12	18	1.7	65
Case CY–1217/U	1	16⅝	15⅝	21⅝	3.2	32
Electrical Dummy Load DA–69/URM–48	1	¾	¾	3¼	----------	----------
Technical Manual TM 11–1257	2	10⅛	¼	7⅞	----------	0.5
Total (SG–12/U)						105
Total (SG–12A/U)						98

Page 11, paragraph 10.

Add "Signal Generator SG–12/U" as a heading over the list of running spares given.

Change the item "1 tube, type 6AQ5" to read: **1 tube, type 6AK6.**

Add the following column.

Signal Generator SG–12A/U

1 tube, type 0A2.
1 tube, type 5Y3WGTA.
2 tubes, type 6AH6.
1 tube, type 6AK6.
1 tube, type 6C4W.
1 tube, type 6J6W.
1 tube, type 12AU7.
1 resistor, thermal; Amperite 9–4.
5 fuses, 1-ampere.
1 lamp 120-volt, 3-watt.
1 lamp, neon.
1 lamp, 6-volt, 0.2-ampere.
1 lamp, 6-volt, 0.15-ampere.

Page 12, paragraph 12.

d. (Added) Signal Generator SG–12A/U has a different set of crystals to provide more commonly used of output signals to equipments under test. In addition, 10 crystal frequencies are provided with one spare position instead of the nine frequencies with two spares provided in SG–12/U. Ruggedized versions of tubes V6, V9, V10, V12, and V13 are used. A 1N21C crystal replaces the 1N21B used in the rf voltage metering circuit in previous models and potentiometers R60, R61, and R62 in the modulator of output stage are changed to JAN standard 25,000-ohm type. Resistor R25 has been eliminated from the grid circuit of modulator V5 and resistor R24 has been increased to 6,800 ohms to make up for the deletion. Resistors R47 (plate load of tube V8) and R48 (B+ decoupling) have been changed to 2 watts and IF. LEVEL potentiometer R91 to 4 watts. Capacitors C70 through C76 have been added to the circuit.

Page 15, figure 5.

NOTE (Added): IN SIGNAL GENERATOR SG–12A/U:
V6 IS TUBE TYPE 6J6W
V9, V12, AND V13 ARE TUBE TYPE 6C4W
V10 IS TUBE TYPE 5Y3WGTA.

Page 15, paragraph 15. **Caution:** Change "(fig. 7)" to read: **(figs. 7 and 7.1).**

Page 16, paragraph 16*c*. Delete the first three sentences in (1) and substitute the following:

(1) The if. cable is used when an if. signal is to be supplied to the mixer or if. amplifier of a receiver. With Signal Generator SG–12/U, the if. signal may be applied directly across a grid resistor, or through a blocking capacitor when used with circuits above ground or containing B+ voltages. In Signal Generator SG–12A/U, blocking capacitor C70 forms an integral part of the if. cable termination. Termination impedance in both SG–12/U and SG–12A/U is 25 ohms.

Page 18, paragraph 19.

Change "(fig. 7)" to read: **(figs. 7 and 7.1).** Change the function of the IF. FREQUENCY MC Switch (S8) to read as in the chart below:

Control	Function
IF. FREQUENCY MC switch (S8).	Selects the proper crystals and tuning circuits to provide the desired output frequencies. In SG–12/U these frequencies are 1.4, 2.515, 2.65, 2.88, 4.3, 4.45, 5.00, 5.35, and 15.0 mc. Two spare positions are provided for future use. In SG–12A/U these frequencies are 1.37, 1.40, 1.43, 4.27, 4.30, 4.33, 4.45, 5.00, 5.35, and 15.00 mc and one spare position is provided for future use.

Page 20, paragraph 22*a*(2). Lines 5 and 6. Change "60" mc to: **50** mc.

Page 26, paragraph 30. Delete the second sentence and substitute:

A No. 6 allen wrench is furnished with Signal Generator SG–12A/U.

Page 29, paragraph 34*b*(1). Change the references in the last sentence to read: **See figure 5 for tube locations.**

Page 29, paragraph 34*b*(2). Change the references in the last sentence to read: **See figures 13, 14, 33, 33.1, 35, 35.1, 36, 37, 37.1, 40, and 40.1 for capacitor locations.**

Page 29, paragraph 34*b*(4). Change the reference in the last sentence to read: **See figures 40 and 40.1 for terminal board locations.**

Page 29, paragraph 34*b*(7). Change the references in the last sentence to read: **Refer to figures 13, 14, 32, 33, 33.1, 34, 35, and 35.1 for component locations.**

42.1 Interchangeable Tubes

(Added)

Refer to the chart below. The older type tube can be used interchangeably with the corresponding preferred type tube. The second column lists the stages in which the tubes can be used in Signal Generator SG–12/U. The preferred type tubes are supplied with Signal Generator SG–12A/U.

Older type tube	Application	Preferred tube
6J6	V6, rf oscillator	6J6W
5Y3GT	V10, rectifier	5Y3WGTA
6C4	V9, modulator af output, and V12 and V13 if. oscillators.	6C4W

Page 38, paragraph 46. Line 3. Change "refer to figures 48 and 49" to read: **refer to figures 48, 49, and 50.**

Page 38, paragraph 46*d*. Line 2. Change "6J6" to read: **6J6 (or 6J6W).**

Page 39, figure 16.

NOTE (Added): IN SIGNAL GENERATOR SG–12A/U:
V6 IS TUBE TYPE 6J6W
V9, V12, AND V13 ARE TUBE TYPE 6C4W
V10 IS TUBE TYPE 5Y3WGTA.

Page 40, paragraph 46*h*. Line 3. Change "6C4" to read: **6C4 (or 6C4W).**

Page 40, paragraph 46*h*. Delete the sentence "Nine crystal frequencies *** associated tuned circuits." and substitute the following:

In Signal Generator SG–12/U, nine crystal frequencies are available, and provision is made for the addition of two more crystals and their associated tuned circuits. In Signal Generator SG–12A/U, 10 crystal frequencies are available, and provision is made for the addition of 1 more crystal and its associated tuned circuit.

Page 40, paragraph 46*j*. Line 11. Change "5Y3GT" to read: **5Y3GT (or 5Y3WGTA).**

Page 44, paragraph 50*a*. Line 4. Change "6J6" to read: **6J6 (or 6J6W).**

Facing page 44, figure 19. Change "NOTE" to **NOTES:**

4. (Added) IN SIGNAL GENERATOR SG–12A/U RESISTOR R24 IS 6,800 OHMS; RESISTOR R25 IS DELETED AND RESISTOR R24 IS CONNECTED TO CHOKE L3. THE TUBE TYPE FOR V6 IS 6J6W. CAPACITOR C25 IS A 2-SECTION CAPACITOR CONNECTED IN SERIES. EACH SECTION HAS A VARIABLE CAPACITANCE OF 1.8 TO 5.1 μμF. CAPACITOR C75 TO GROUND, WITH A CAPACITANCE OF .01 μμF, IS CONNECTED AT THE JUNCTION OF CHOKE L36 AND FILTER Z16. CAPACITOR C73 TO GROUND, WITH A CAPACITANCE OF .01 μμF, IS CONNECTED AT THE JUNCTION OF CHOKE L7 AND FILTER Z9. CRYSTAL CR2 IS TYPE 1N21C.

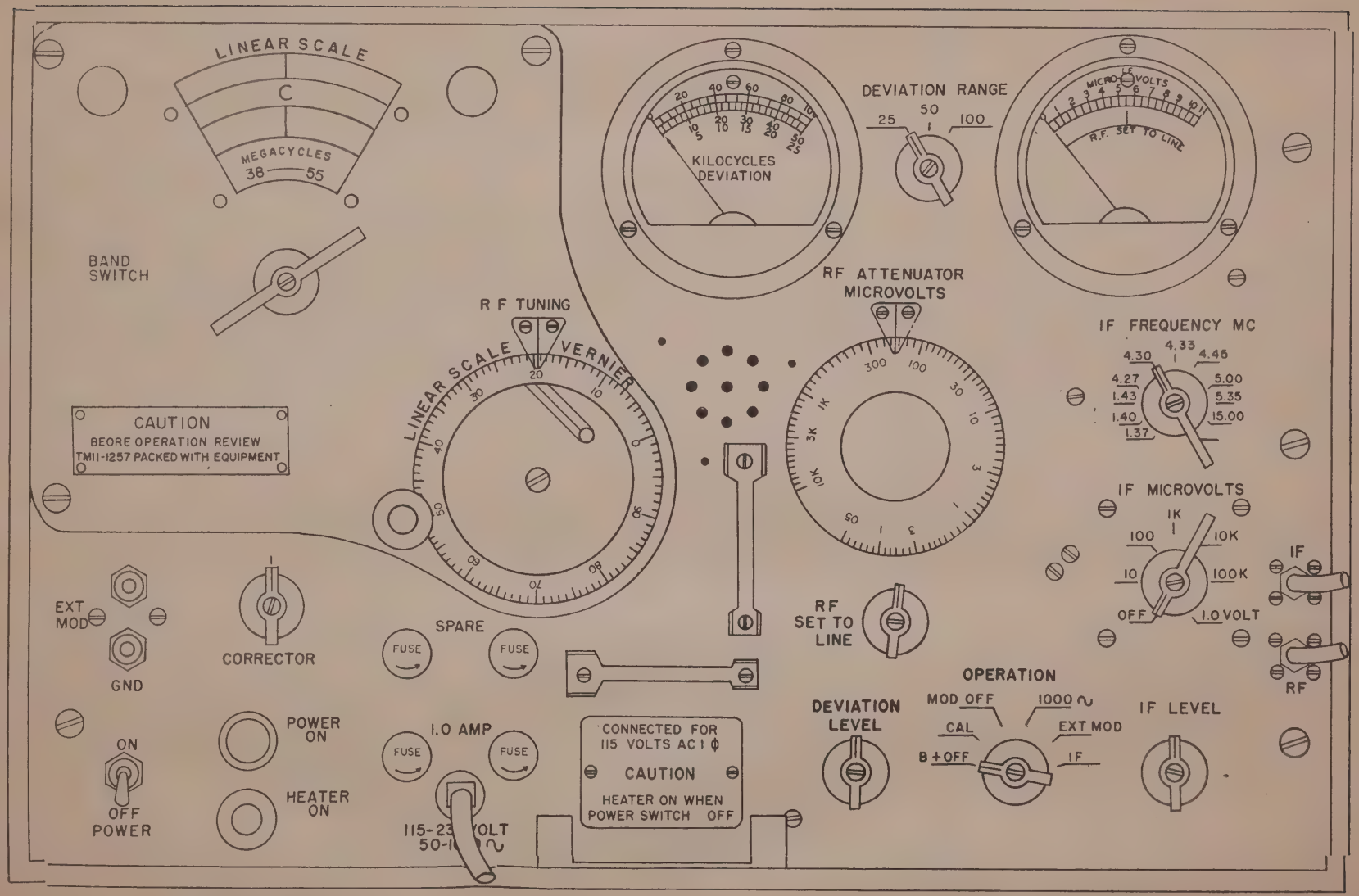


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Figure 7.1 (Added). *Signal Generator SG–12A/U, front panel view.*

Page 48, paragraph 53*c*. Line 1. Change "6C4" to read: **6C4 (or 6C4W).**

Page 49, figure 22. Change "NOTE" to **NOTES.**

4. (Added) IN SIGNAL GENERATOR SG–12A/U TUBE V9 IS A TYPE 6C4W. RESISTORS R60, R61, AND R62 ARE EACH 25K.

Page 50, figure 23. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TERMINAL 3 OF TRANSFORMER T1 IS CONNECTED TO GROUND AND TERMINAL 9 OF J8. TERMINAL 4 OF TRANSFORMER T1 IS CONNECTED TO TERMINAL 11 OF J8.

Page 50, paragraph 55. Line 4. Change "6C4" to read: **6C4 (or 6C4W).**

Page 50, paragraph 55. Delete the third, fourth, and fifth sentences and substitute the following:

In Signal Generator SG–12/U, there are 9 crystal frequencies available in the unit (10 for SG–12A/U) but for the explanation of the circuit, all positions of the switch are considered to operate in the same manner. Signal Generator SG–12/U has two spare turret spaces for installation of additional crystals. SG–12A/U has one spare turret space. Any crystal in the 1- to 20-mc range can be used in the spare turret spaces. Installation of crystals in the spare positions is described in *c* below.

Page 50, paragraph 55*a*. After the second sentence add:

Coil L37 and capacitor C68 make up the tuned circuit for the tenth position of the switch in Signal Generator SG–12A/U.

Page 50, paragraph 55*b*. Delete the first sentence and substitute the following:

The switching circuit for the oscillator and amplifier sections consists of switch S8 and the turret. In Signal Generator SG–12/U, the turret contains nine crystals, Y1 through Y9. In Signal Generator SG–12A/U, the turret contains 10 crystals Y1 through Y9 and Y11.

Page 51, paragraph 55*c*. Delete the first five sentences and substitute the following:

The frequency switching arrangement in the if. oscillator and amplifier circuits has two spare positions in Signal Generator SG–12/U and one spare position in SG–12A/U. Spare positions are included to provide additional if. circuits if required. To make use of a spare position it is necessary to insert the proper crystal in the turret holder, exchange the empty coil form for a wound coil, shunt the inserted coil with the proper capacitance, and wire the tuned circuit into the switching arrangement. All if. oscillator and amplifier coils use the same coil form. The two empty coil forms for each spare position are mounted in usable positions on the front and rear panels of the if. oscillator assembly.

Page 52, paragraph 55*c*. Line 4 from bottom of column. Change "figures 48 and 49" to read: **figures 48, 49, and 50.**

Page 52, figure 25. Interchange the words "front" and "rear" at S8 section 1. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TUBES V12 AND V13 ARE TYPE 6C4W AND THE FREQUENCY OF CRYSTAL Y4 IS 4.27 MC.

Page 53, paragraph 56*b*. Line 1. Change "nine" to read: **9 (or, in Signal Generator SG–12A/U, 10).**

Page 53, figure 26. Add the following to NOTE 3: IN SIGNAL GENERATOR SG–12A/U THIS IS THE 4–27 POSITION.

Page 54, figure 27. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, C70, .01 μF, IS IN SERIES WITH THE RED IF. OUTPUT LEAD AND IS LOCATED IN THE IF. CABLE TERMINATION BOX.

Page 55, paragraph 57*b*. Delete the second sentence and substitute the following:

The if. output cable is terminated by resistor R84 and, in Signal Generator SG–12A/U, blocking capacitor C70.

Page 55, figure 28. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, CRYSTAL CR2 IS TYPE 1N21C.

Page 58, figure 29. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TUBE V10 IS TYPE 5Y3WGTA.

Facing page 58, figure 30. Change "NOTE" to **NOTES.**

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TUBE V10 IS A TYPE 5Y3WGTA. CAPACITOR C71, .01 μF, IS CONNECTED BETWEEN THE JUNCTION OF I 1 AND TERMINAL 15 OF P8 AND GROUND; CAPACITOR C72, .01 μF, IS CONNECTED BETWEEN THE JUNCTION OF I 2 AND TERMINAL 14 OF P8 AND GROUND; C73, .01 μF, IS CONNECTED BETWEEN THE JUNCTION OF L7 AND Z9 AND GROUND; C74, .01 μF, IS CONNECTED BETWEEN THE JUNCTION OF L2 AND Z2 AND GROUND; C75 IS CONNECTED BETWEEN THE JUNCTION OF L36 AND R107 AND GROUND.

Page 60, paragraph 61. Change the figure references in the table as follows:

"33" to read: **33 and 33.1.**
"35" to read: **35 and 35.1.**
"37" to read: **37 and 37.1.**
"39" to read: **39 and 39.1.**
"40" to read: **40 and 40.1.**
"48 and 49" to read: **48, 49, and 50.**

Page 61, paragraph 64*a*. Change the figure references in the last sentence to read: **figures 39, 39.1, 40, and 40.1.**

Page 62, figure 31.

Delete the connection between L15 and terminal 11 of transformer T2. Connect L15 to terminal 12 of transformer T2.

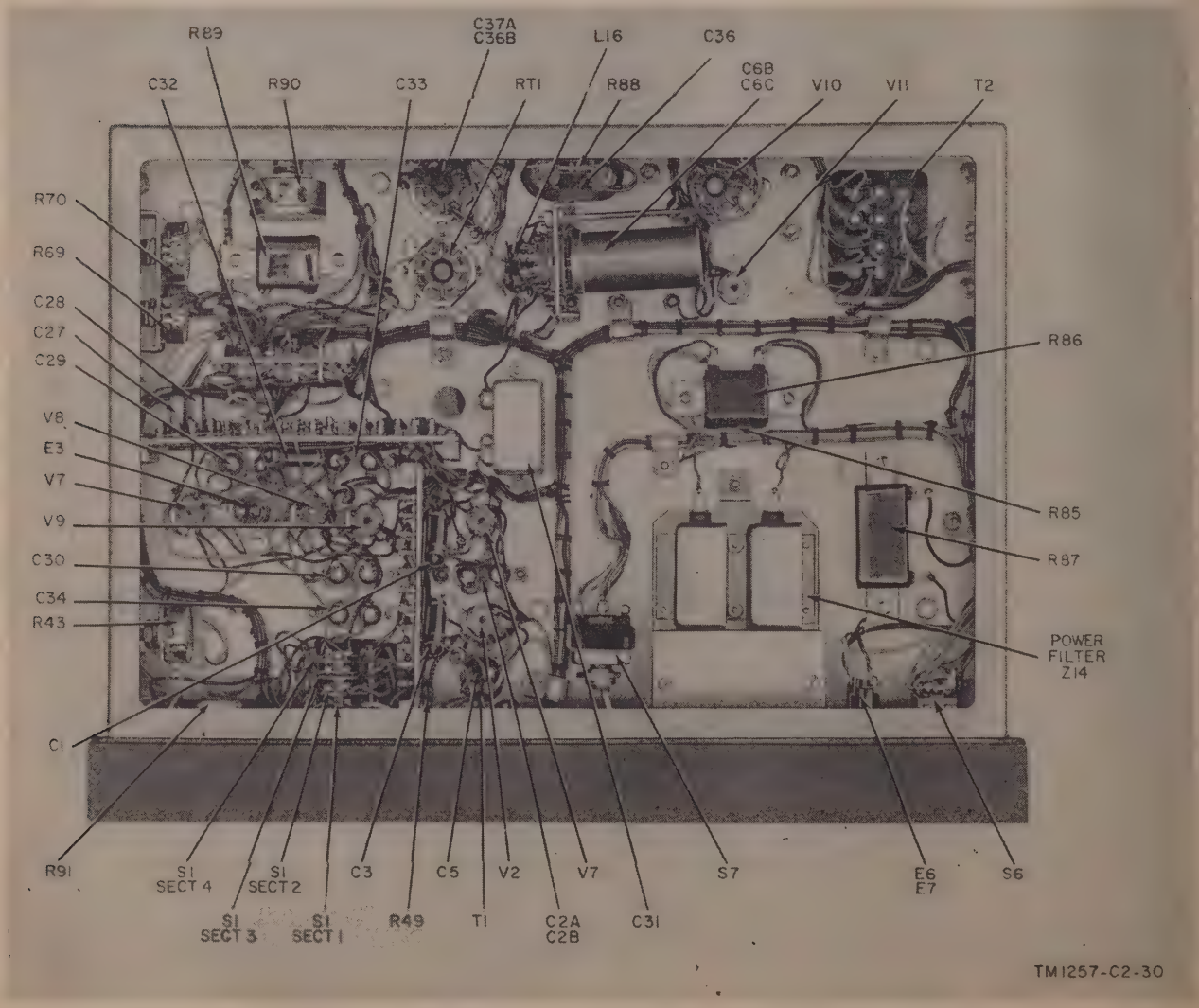

Figure 33.1 (Added). *Signal Generator SG–12A/U, bottom view of chassis.*

3. (Added) IN SIGNAL GENERATOR SG–12A/U, TUBE V6 IS TYPE 6J6W. TUBES V9, V12, and V13 ARE TYPE 6C4W, AND TUBE V10 IS TYPE 5Y3WGTA. RESISTOR R24 IS 6,800 OHMS AND IS CONNECTED DIRECTLY TO CHOKE L3. RESISTOR R25 IS NOT USED. CHANGE THE SYMBOL FOR CAPACITOR C25 TO A 2-SECTION CAPACITOR CONNECTED IN SERIES, EACH SECTION HAVING A VARIABLE CAPACITANCE OF 1.8 TO 5.1 μμF.

Page 63, paragraph 66. Change the reference in the last sentence from "figure 39" to read: **figures 39 and 39.1.**

Page 75, paragraph 76*d*. Change reference in last line to: **(figs. 48, 49, and 50).**

Page 78, paragraph 85*b*(6). Change "30 mc" to read: **39 mc.**

Page 80, figure 41. Change callout marked "R76" to: **R70**.

Page 80, figure 42. Change control marked "R32" to: **R23**.

Page 81, paragraph 89*b*. Delete the first sentence and substitute the following:

For Signal Generator SG–12/U, refer to the following chart for adjustment points in *a*(4) and (5) above.

Page 81, paragraph 89.

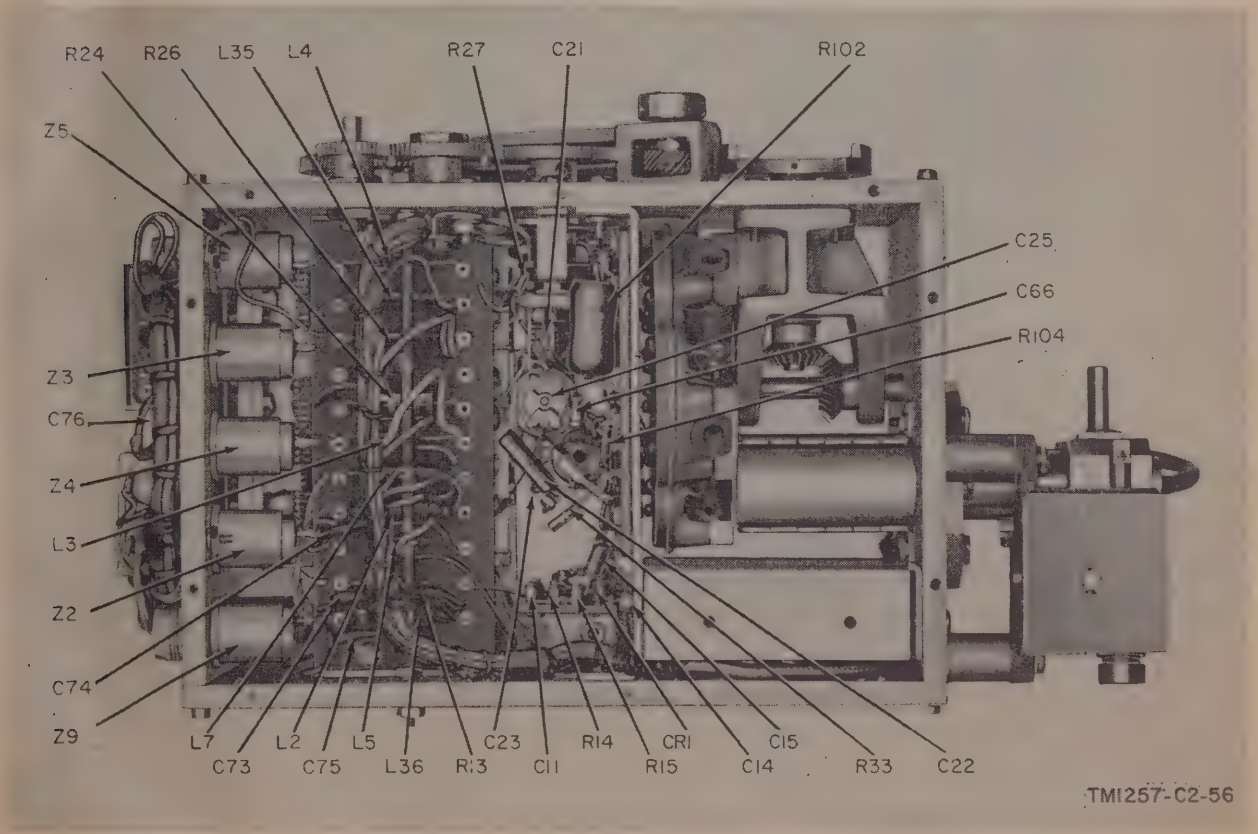

Figure 35.1 (Added). *Signal Generator SG–12A/U, rf oscillator subassembly, bottom view.*

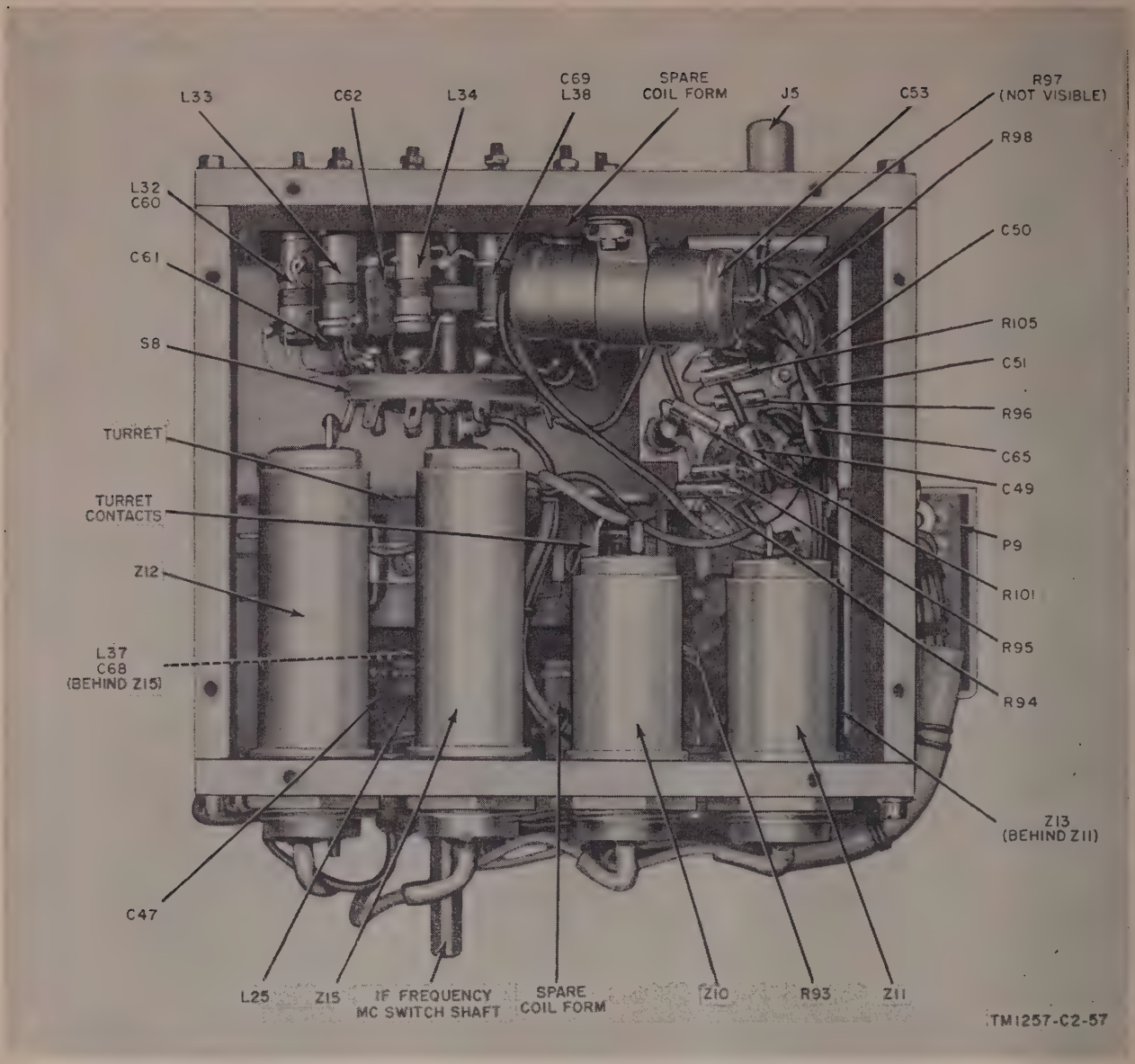

Figure 37.1 (Added). *Signal Generator SG–12A/U, if. oscillator subassembly, bottom view.*

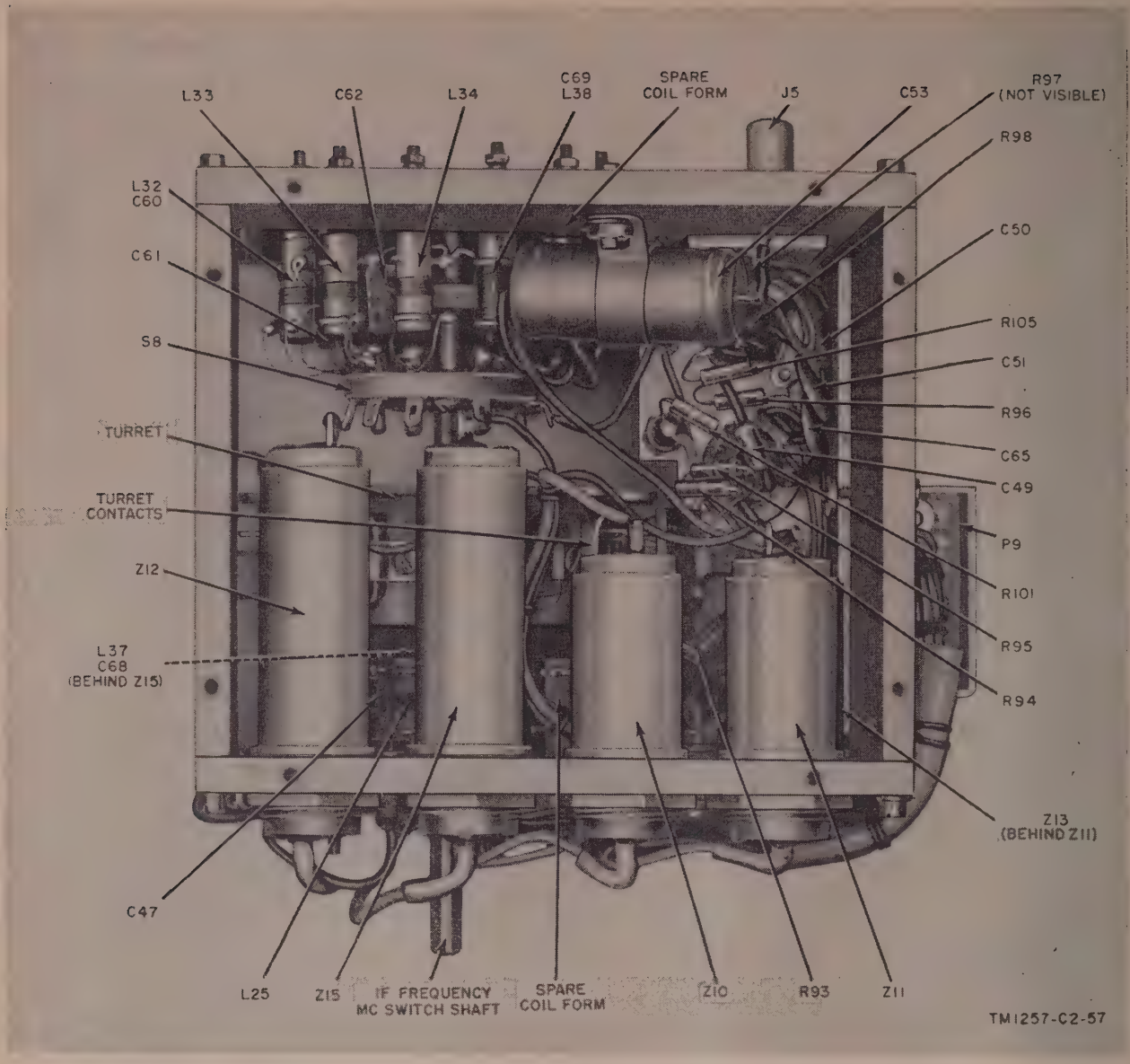

Figure 37.1 (Added). *Signal Generator SG–12A/U, if. oscillator subassembly, bottom view.*

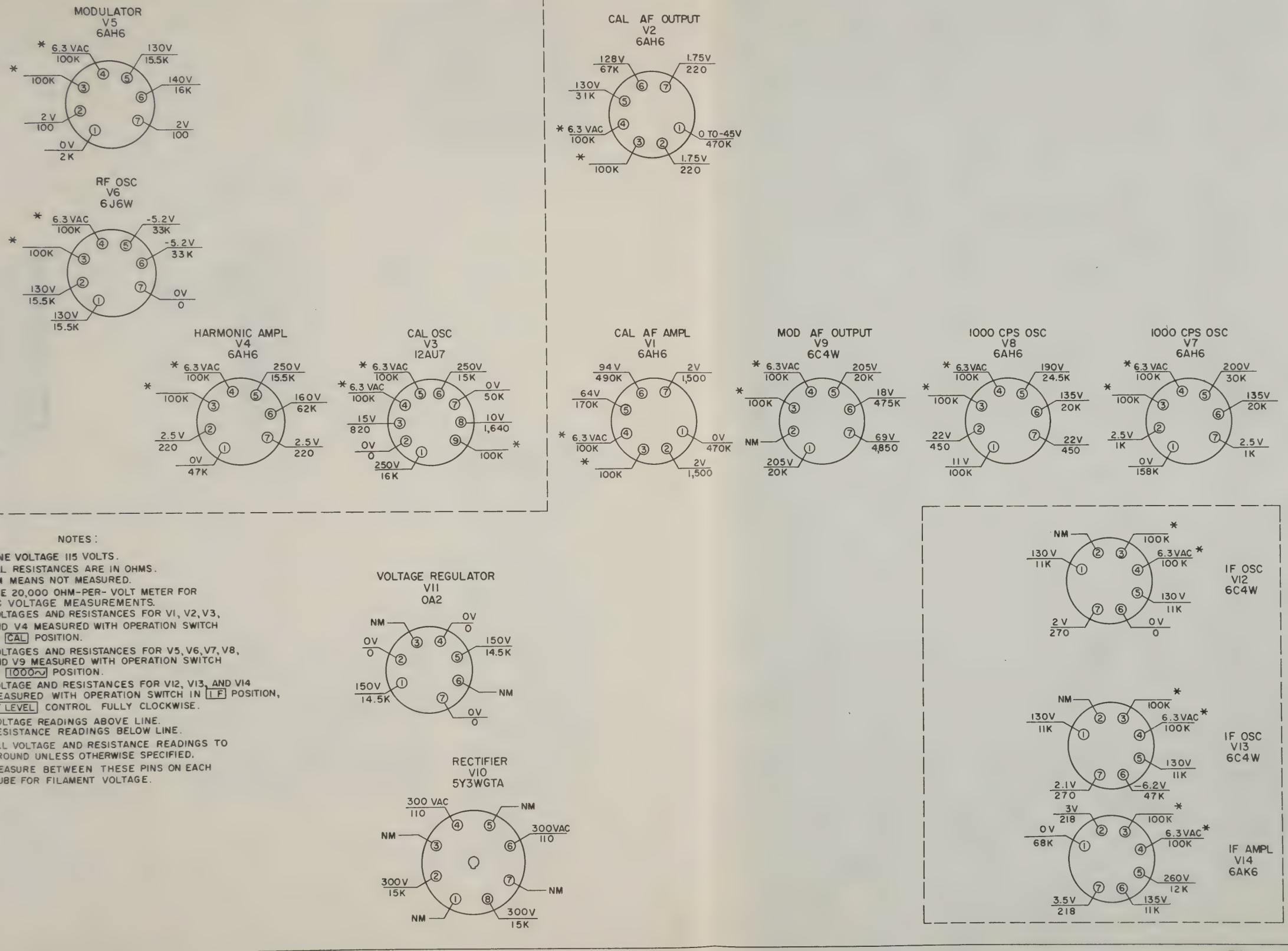

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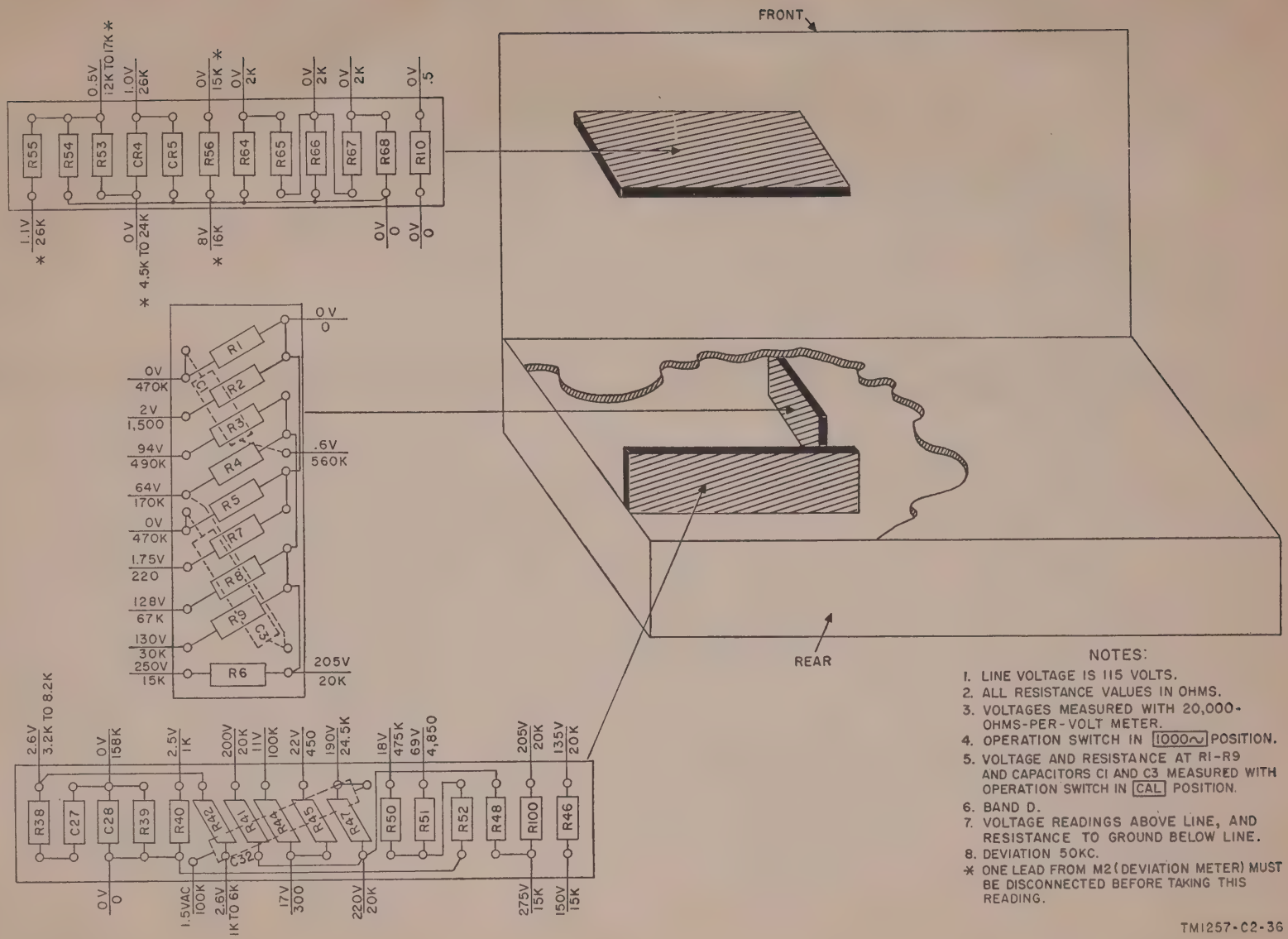
Figure 39.1 (Added). *Signal Generator SG–12A/U, voltage and resistance diagram.*



NOTES:

1. LINE VOLTAGE IS 115 VOLTS.
2. ALL RESISTANCE VALUES IN OHMS.
3. VOLTAGES MEASURED WITH 20,000-OHMS-PER-VOLT METER.
4. OPERATION SWITCH IN [1000~] POSITION.
5. VOLTAGE AND RESISTANCE AT R1–R9 AND CAPACITORS C1 AND C3 MEASURED WITH OPERATION SWITCH IN [CAL] POSITION.
6. BAND D.
7. VOLTAGE READINGS ABOVE LINE, AND RESISTANCE TO GROUND BELOW LINE.
8. DEVIATION 50KC.

* ONE LEAD FROM M2 (DEVIATION METER) MUST BE DISCONNECTED BEFORE TAKING THIS READING.

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Figure 40.1. Signal Generator SG–12A/U, resistor-capacitor board location diagram.

c. (Added) For Signal Generator SG–12A/U, refer to the following chart for adjustment points in *a*(4) and (5) above.

IF. FREQUENCY MC	Adjust oscillator coil	Adjust amplifier coil
1.37	L21	L30
1.40	L20	L29
1.43	L19	L28
4.27	L18	L27
4.30	L17	L26
4.33	L22	L31
4.45	L23	L32
5.00	L24	L33
5.35	L25	L34
15.00	L37	L38

Page 82, figure 43.

NOTE (Added): IN SIGNAL GENERATOR SG–12A/U, ON THE FRONT VIEW OF THE IF. ASSEMBLY, "L37" IS STAMPED NEXT TO THE ADJUSTMENT MARKED "SPARE" WHICH IS ADJACENT TO "L25." ON THE REAR VIEW OF THE IF. ASSEMBLY, "L38" IS STAMPED NEXT TO THE ADJUSTMENT MARKED "SPARE" WHICH IS ADJACENT TO "L34".

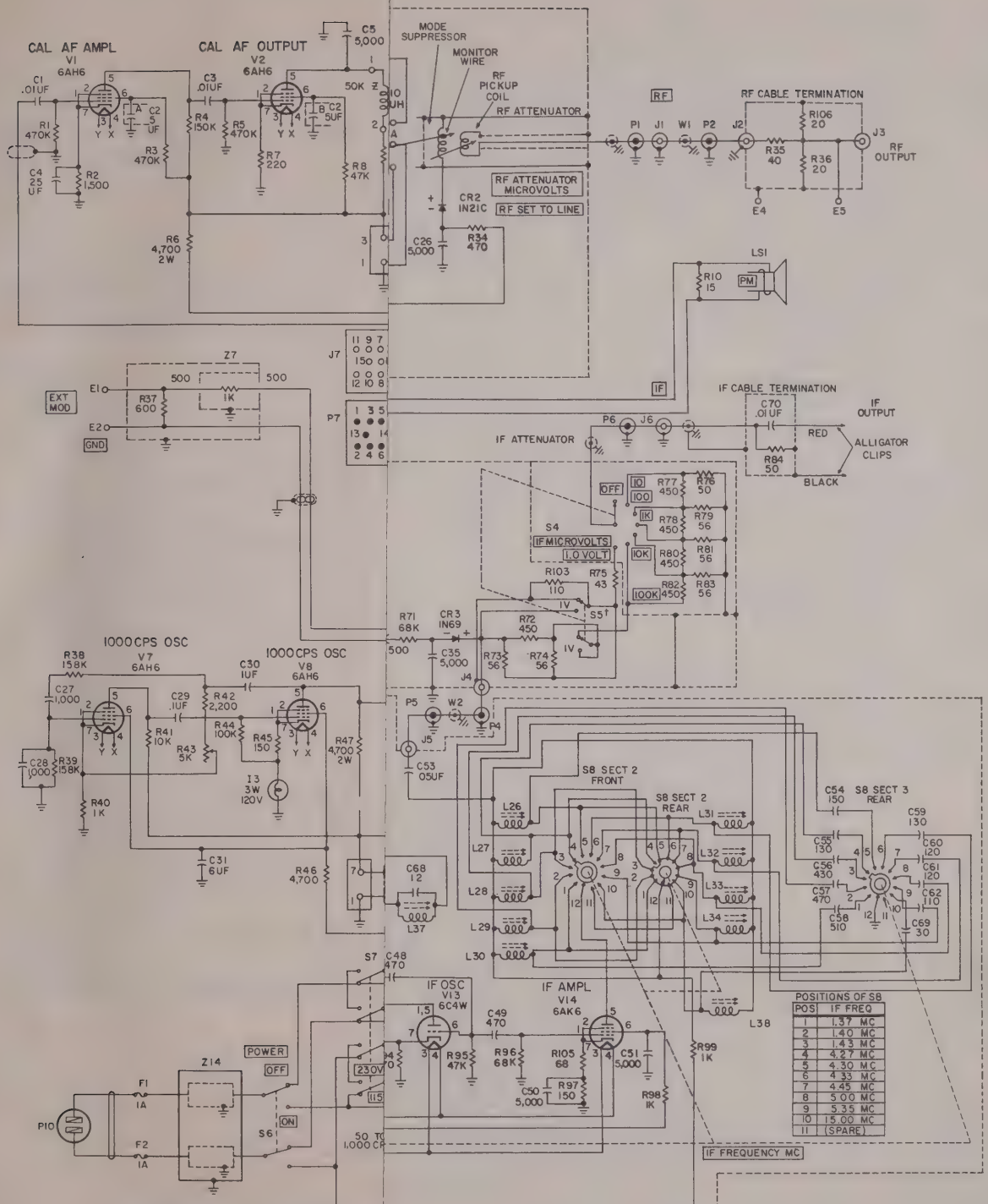
Page 86, paragraph 102*b*. Line 3. Change "±10 percent" to read: **±25 percent**.

Figure 48. (foldout) Change the value of C2 to: **5μF.**

Figure 49. (foldout) Change the value of C2 to: **5μF.** Label the resistor directly below R24: R25, 3,300, 2W.

Page 91, appendix I. Deleted.

Page 93, appendix II. Deleted.



NOTES :

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, AND ARE 1/2 WATT. ALL CAPACITORS ARE IN UUF.
2. #RESISTOR BUILT INTO LAMP SOCKET.
3. †S5 IN POSITION SHOWN FOR ALL POSITIONS OF S4 EXCEPT 1.0 VOLT
4. SWITCHES VIEWED FROM FRONT PANEL.
5. PLUGS AND JACKS ARE VIEWED FROM WIRE END
6. NAMES IN BOXES INDICATE FRONT PANEL MARKING

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c. (Added) For Signal Generator SG–12A/U, refer to the following chart for adjustment points in *a*(4) and (5) above.

IF. FREQUENCY MC	Adjust oscillator coil	Adjust amplifier coil
1.37	L21	L30
1.40	L20	L29
1.43	L19	L28
4.27	L18	L27
4.30	L17	L26
4.33	L22	L31
4.45	L23	L32
5.00	L24	L33
5.35	L25	L34
15.00	L37	L38

Page 82, figure 43.

NOTE (Added): IN SIGNAL GENERATOR SG–12A/U, ON THE FRONT VIEW OF THE IF. ASSEMBLY, "L37" IS STAMPED NEXT TO THE ADJUSTMENT MARKED "SPARE" WHICH IS ADJACENT TO "L25." ON THE REAR VIEW OF THE IF. ASSEMBLY, "L38" IS STAMPED NEXT TO THE ADJUSTMENT MARKED "SPARE" WHICH IS ADJACENT TO "L34".

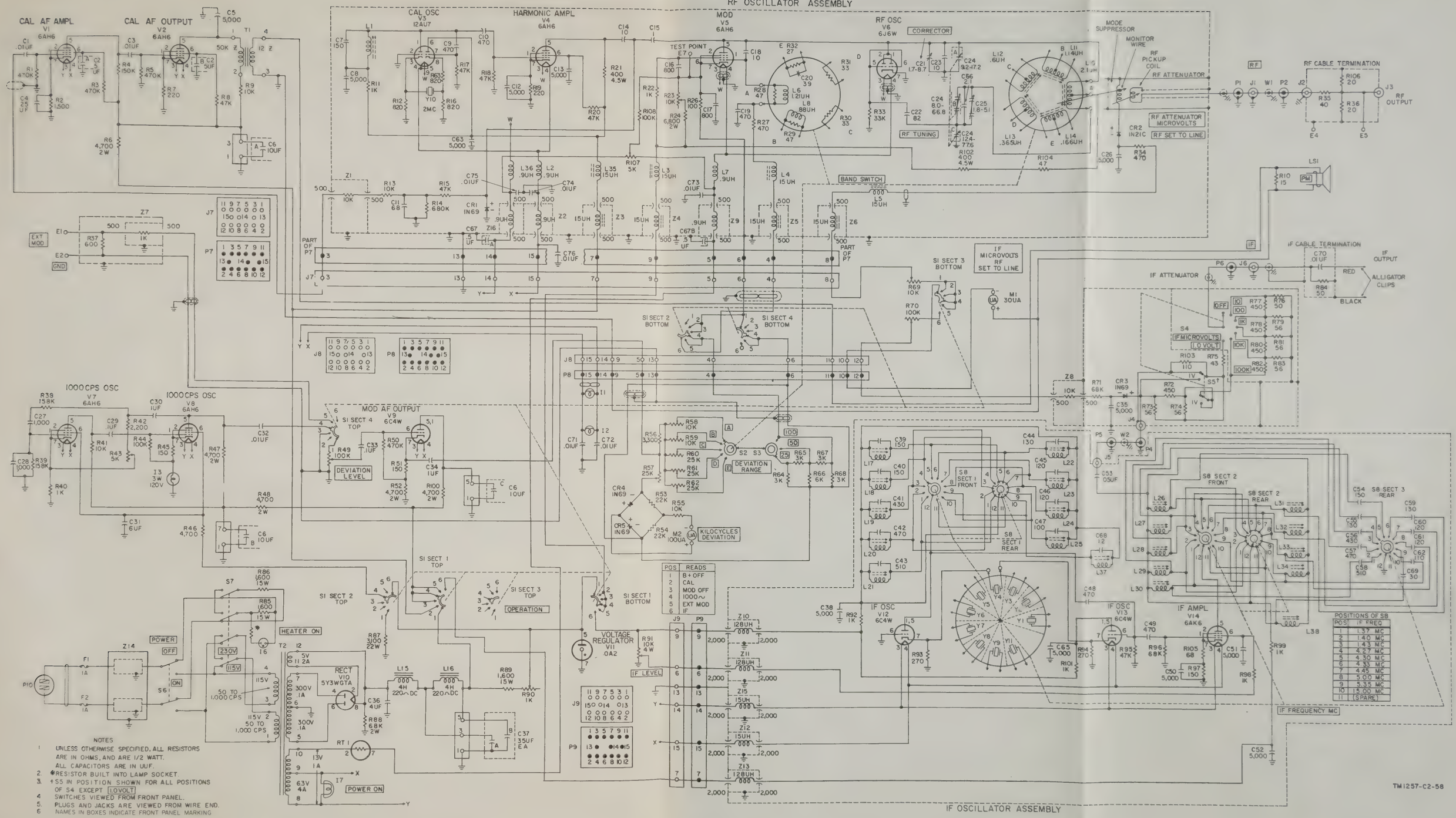
Page 86, paragraph 102*b*. Line 3. Change "±10 percent" to read: **±25 percent**.

Figure 48. (foldout) Change the value of C2 to: **5μF.**

Figure 49. (foldout) Change the value of C2 to: **5μF.** Label the resistor directly below R24: R25, 3,300, 2W.

Page 91, appendix I. Deleted.

Page 93, appendix II. Deleted.



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, AND ARE 1/2 WATT. ALL CAPACITORS ARE IN UUF.
2. *RESISTOR BUILT INTO LAMP SOCKET.
3. †S5 IN POSITION SHOWN FOR ALL POSITIONS OF S4 EXCEPT 1.0 VOLT
4. SWITCHES VIEWED FROM FRONT PANEL.
5. PLUGS AND JACKS ARE VIEWED FROM WIRE END.
6. NAMES IN BOXES INDICATE FRONT PANEL MARKING

Figure 50 (Added). *Signal Generator SG–12A/U, schematic diagram.*

[AG 412.41 (31 Jul 56)]

By Order of the Secretaries of the Army and the Air Force:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

N. F. TWINING,
Chief of Staff, United States Air Force

Official:

E. E. TORO,
Colonel, United States Air Force,
Air Adjutant General.

Distribution:

Active Army:

CNGB (1)
ASA (3)
Tec Svc, DA (1) except CSIGO (30)
Tec Svc Bd (1)
Hq CONARC (5)
CONARC Bd (Incl ea Test Sec) (1)
Army AA Comd (2)
OS Maj Comd (5)
OS Base Comd (5)
Log Comd (5)
MDW (1)
Armies (5)
Corps (2)
Ft & Cp (2)
Sp Wpn Comd (2)
Army Cml Cen (4)
Gen & Br Svc Sch (5) except Sig Sch (25)
Gen Depots (2) except Atlanta Gen Depot (None)
Sig Sec, Gen Depots (10)
Sig Depots (17)
US Army Tng Cen (2)
POE (OS) (2)
Trans Terminal Comd (2)
Army Terminals (2)
OS Sup Agencies (2)
Army Elct PG (1)
Sig Fld Maint Shops (3)
Sig Lab (5)
ACS (3)
Sandia Base, AFSWP (2)
Mil Dist (1)
Units org under fol TOE:
11–7C, Sig Co, Inf Div (2)
11–16C, Hq & HqCo, Sig Bn, Corps or Abn Corps (2)
11–57C, Armd Sig Co (2)
11–127R, Sig Rep Co (2)
11–128R, Sig Depot Co (2)
11–500R (AA–AE), Sig Svc Org (2)
11–557C, Abn Sig Co (2)
11–587R, Sig Base Maint Co (2)
11–592R, Hq & Hq Co, Sig Base Depot (2)
11–597R, Sig Base Depot Co (2)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

U. S. GOVERNMENT PRINTING OFFICE: 1956—400610

SIGNAL GENERATOR AN/URM–48

TM 11–1257
TO 33A1–8–18–1
CHANGES No. 3

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., *2 May 1961*

TM 11–1257/TO 33A1–8–18–1, 8 December 1953, is changed as follows:

Note. The parenthetical references to previous changes ("example: page 2 of C2") indicate that pertinent material was published in that change.

Page 11, paragraph 10 (page 2 of C 2), "Signal Generator SG–12A/U" column, item 9. After "5 fuses, 1-ampere," add: slow blow.

Page 18. After paragraph 18 add:

Note. A difference of potential exists between the chassis of Signal Generator SG–12(*)/U, a component of Signal Generator AN/URM–48, and the equipment under test. The use of capacitors as ac line filters causes this difference in potential, which is annoying but not dangerous. To eliminate this voltage, connect the chassis of the equipment under test to the external ground terminal of the signal generator.

Page 82. After section III, add:

Section III.1. FOURTH ECHELON TESTING PROCEDURES

90.1 General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures set fourth specific requirements that repaired signal equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide for testing equipment repaired at third echelon if the proper tools and test equipments are available. A summary of the performance standards is given in paragraph 90.13.

b. Each test depends on the preceding one for certain operating procedures and where applicable, for test equipment calibrations. Comply with the instructions preceding each chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all the actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

90.2 Test Equipment and Materials

All test equipment and materials required to perform the testing procedures given in this section are listed in the following charts and are authorized under TA 11–17, Signal Field Maintenance Shops, and TA 11–100–(11–17), Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States, except as noted.

a. Test Equipment.

Nomenclature	Federal stock No.	Technical manual
Frequency Meter FR–4/U (p/o Frequency Meter AN/URM–79)	6625–668–9749	TM 11–5094
Frequency Meter AN/URM–80	6625–649–4286	TM 11–5095
Signal Generator TS–497(*)/URR [a]	6625–669–0258	TM 11–5030 TM 11–5030A
Audio Oscillator TS–382(*)/U [b]	6626–192–5094	TM 11–2684A
Spectrum Analyzer TS–723(*)/U [c]	6625–668–9418	TM 11–5097
Frequency Meter FR–67/U [d]	6625–356–0256	TM 11–2698

Nomenclature	Federal stock No.	Technical manual
Panoramic Indicator IP–173/U	5820–224–5500	TM 11–5086
Panoramic Indicator IP–173A/U [e]	5820–699–8116	
Field Strength Meter IM–117/URM–91 (p/o AN/URM–91)	6625–521–1270	TM 11–5041
Field Strength Meter TS–579(*)/U [f]	6625–242–5950	TM 11–5041
Wattmeter AN/URM–98	6625–566–4990	TM 11–5124
Electronic Multimeter TS–505(*)/U [g]	6625–243–0562	TM 11–6625–239–12
		TM 11–5511
Electronic Multimeter ME–30(*)/U [h]	6625–669–0742	TM 11–5132
Light Assembly, Electric MX–1292/PAQ	6695–537–4470	TM 11–5540

[a] Indicates models TS–497A/URR, TS–497B/URR, and TS–497C/URR.

[b] Indicates models TS–382A/U, TS–382B/U, TS–382D/U, TS–382E/U, and TS–382F/U.

[c] Indicates models TS–723/U, TS–723A/U, and TS–723B/U.

[d] Frequency Meter AN/TSM–16 and Radio Interference Measuring Set AN/URM–85, authorized under TA 11–17 were purposely omitted in favor of frequency Meter FR–67/U and Field Strength Meter, TS–579/U which are most likely to be available. Frequency Meter AN/TSM–16 and Radio Interference Measuring Set AN/URM–85 may be used if available.

[e] Indicates stock number for IP–173A/U.

[f] Indicates models TS–579/U, and TS–597A/U.

[g] Indicates models TS–505/U, TS–505A/U, TS–505B/U, TS–505C/U, and TS–505D/U.

[h] Indicates models ME–30A/U, and ME–30B/U.

b. Materials and Other Equipment.

Nomenclature	Federal stock No.	Reference
Radio Receiver R–390/URR	5820–503–1242	TM 11–856
Headset HS–30/U	5965–164–7259	None.
Adapter Connector UG–29B/U	5935–149–3950	None.
Adapter Connector UG–201/U	5935–201–3096	None.
Telephone plug, Type No. PJ–055B	5935–192–4760	None.
Cable, 2 cond; standard; #18AWG 3 ft [a]	6245–251–3542	None.

[a] Any two-conductor, insulated, standard cable, or two 3-foot lengths of hookup wire will be suitable.

Note. A special purpose test cable is required to make connections to the audio output jack of Field Strength Meter AN/URM–91 in the modulation distortion and frequency test and the noise test (pars. 90.9 and 90.10). Fabricate this cable using figure 43.1 as a guide. The necessary materials are listed in the chart above.

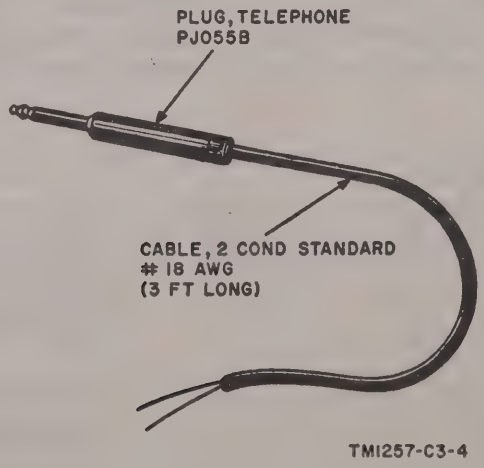


Figure 43.1 Special test cable fabrication.

90.3 Modification Work Orders

The performance standards listed in the tests (pars. 90.5–90.13) assume that the modification work orders listed below have been performed. A list of modification work orders is published in DA Pamphlet 310–4.

MWO No.	Date	Priority	Echelon	Location of MWO marking	Remarks
11–6625–267–45/2	9 Jun 59	4	4 and 5	Front of panel beneath or adjacent to nameplate.	Applies to Signal Generator SG–12/U only, all sets including depot stocks.

90.4. Moistureproofing and Fungiproofing

All parts and areas disturbed by repair and for testing will be checked for proper moistureproofing and fungiproofing.

90.5. Physical Tests and Inspection

a. Test Equipment and Materials

Light Assembly, Electric MX–1292/PAQ
Electronic Multimeter TS–505A/U

b. Test Connections and Conditions.

(1) Do not connect the SG–12A/U to a source of power for this test.

(2) Prepare the electric light assembly for operation by connecting the mercury vapor lamp with the wide transmission filter installed.

(3) The moistureproofing and fungiproofing test (step No. 5 below) should be conducted after repairs have been completed but before the chassis has been assembled in its cabinet.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	None.	Controls may be in any position.	*a.* Inspect the SG–12A/U for loose and missing screws, nuts, and other small parts.	*a.* All screws and nuts are tight. No parts are missing.
			b. Inspect the RF and IF output cables, and the line cord for condition of the cable, and of the cable termination.	*b.* The cables are in good condition free from cuts, cracks, abrasions, burns, signs of deterioration or other damage. Terminations are properly and firmly attached to the cables and are free from damage.
			c. Inspect the SG–12A/U and dust cover (cabinet) for evidence of physical damage and condition of finish and panel lettering. *Note.* Touchup painting is recommended in lieu of refinishing whenever practicable.	*c.* No physical damage is evident. All surfaces intended to be painted do not show bare metal. Panel lettering is legible.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
			d. Remove the fuseholder caps and inspect the fuseholders (and caps) for damage. Check the fuses for correct size and type.	*d.* The fuseholders (and caps) are not damaged. Fuses are 1 ampere of the slow-blow type.
			e. Check the KILOCYCLES DEVIATION meter, and the IF MICROVOLTS, RF. SET TO LINE meter for condition of the pointers and meter zero settings.	*e.* The meter pointers are straight and are not at zero indication on the meter scales with the SG–12A/U in normal operating position.
			f. If available, inspect the Case CY–1217/U (transit case) for loose and missing parts, damage, and condition of finish.	*f.* The transit case is not damaged nor are any parts loose or missing. All surfaces intended to be painted do not show bare metal.
2	None.	Controls may be in any position.	*a.* Turn the knobs of the following switches to *each* of their indicated positions: (1) OPERATION. (2) IF MICROVOLTS. (3) IF FREQUENCY MC. (4) DEVIATION RANGE.	*a.* The switch functions smoothly without binding or excessive looseness. Switch detents are positive. Switch knobs are tight on their shafts and properly indexed.
			b. Turn the knobs of the following controls through their limits of travel. (1) IF LEVEL. (2) DEVIATION LEVEL. (3) RF SET TO LINE. (4) CORRECTOR.	*b.* The controls operate smoothly without binding or excessive looseness. Control knobs are tight on their shafts.
			c. Turn the RF ATTENUATOR MICROVOLTS control fully clockwise to the stop.	*c.* The control turns freely without binding or excessive looseness. The knob turns the dial without slipping. The 10K dial mark lies directly under the hairline when the stop is reached.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
			d. Turn the RF ATTENUATOR MICROVOLTS control fully counterclockwise to the stop.	*d.* The control turns freely without binding or excessive looseness.
			e. Test the RF ATTENUATOR MICROVOLTS dial clutch by continuing to turn the knob counterclockwise 1 or 2 revolutions after the stop has been reached (*d* above).	*e.* The RF ATTENUATOR MICROVOLTS dial remains stationary as the knob is turned. The effort required to turn the knob is not so great as to place undue stress on the stop mechanism.
			f. Turn the BAND SWITCH knob to each of the four band positions indicated by the successive appearance of masks in the dial window labeled A, B, C, D, and E.	*f.* The BAND SWITCH functions smoothly without binding or excessive looseness. Switch detents are positive and the switch knob is tight on its shaft.
			g. Turn the RF TUNING control counterclockwise until the stop is reached. Note the indications of both the LINEAR SCALE (on the RF TUNING dial) and VERNIER dial.	*g.* The tuning mechanism operates smoothly without binding or excessive looseness. The knob turns the tuning dial without slipping. The zero marks on both the LINEAR SCALE and the VERNIER dial lie directly under the index hairline.
			h. Turn the RF TUNING control clockwise until the stop is reached. Note the indication on the LINEAR SCALE of the TUNING dial.	*h.* The tuning mechanism operates smoothly without binding or excessive looseness. The LINEAR SCALE of the RF TUNING dial indicates when the stop is reached.
			i. Test the RF TUNING dial clutch by continuing to turn the dial knob clockwise 1 or 2 revolutions after the stop has been reached (*h* above).	*i.* The RF TUNING dial remains stationary as the knob is turned. The effort required to turn the knob is not so great as to place undue stress on the RF TUNING dial stop mechanism.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
3	*TS–505A/U* Function switch: OHMS. RANGE switch: 2.5V–RXI.	N/A	*a.* Inspect Electrical Dummy Load DA–69/URM–48 dummy antenna for damage, loose, and missing parts.	*a.* There are no loose or missing screws or other small parts. No damage is evident.
			b. Prepare the TS–505A/U for making resistance measurements as follows: (1) Connect power cord to 115 vac source. (2) Adjust the OHMS ADJ control for a full scale (infinity) indication on the OHMS scale of the meter. (3) Short the probe tips of the OHMS and COMMON leads together, and adjust the ZERO ADJ control for an indication of zero on the meter.	*b.* None.
			c. Connect the COMMON probe to the center conductor of one dummy antenna connector connector and the tip of the OHMS probe to the center conductor of the other connector. Note the indication on the TS–505A/U meter (OHMS scale).	c. The meter indicates within 64–72 ohms.
4	Same as step No. 3.	N/A	*a.* Remove the RF OUTPUT cable head from the RF OUTPUT cable and inspect it for damage, loose, or missing parts.	*a.* There are no loose or missing screws or other small parts. No damage is evident.
			b. Touch the COMMON probe tip of the TS–505A/U to the case of the RF OUTPUT cable termination head and touch the OHMS probe tip to the center conductor of the female connector. Note the indication on the meter.	*b.* The meter indicates within 47.5–52.5 ohms.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
			c. Touch the COMMON probe tip of the electronic multimeter to the case of the RF OUTPUT cable termination head and touch the OHMS probe tip to the center conductor of the *male* connector. Note the indication on the meter.	*c.* The meter indicates within 9.5–10.5 ohms.
5	*MX–1292/PAQ* 245V FOR MV LAMP switch: OFF.	Controls may be in any position.	*a.* Connect the power cord of MX–1292/PAQ to a source of 115 volt, 60-cycle power and turn on the mercury vapor lamp (switch labeled 245V FOR MV LAMP).	*a.* None.
			b. Expose the areas of the SG–12A/U that have been repaired or otherwise disturbed to the direct rays of the lamp.	*b.* All electrical components, wires, connections, and chassis surfaces show continuous unbroken coverage. There must be *no* varnish on switch contacts or moving parts of mechanical assemblies. *Note.* Moistureproofing and fungiproofing varnish glows gray-green when exposed to the rays of the lamp.
6	N/A	Controls may be in any position.	Check the equipment for applicable MWO's and proper marking. *Note.* See paragraph 90.3 for a list of applicable and allied information.	All applicable MWO's have been performed. The equipment bears the proper markings in the designated location for each MWO applied.

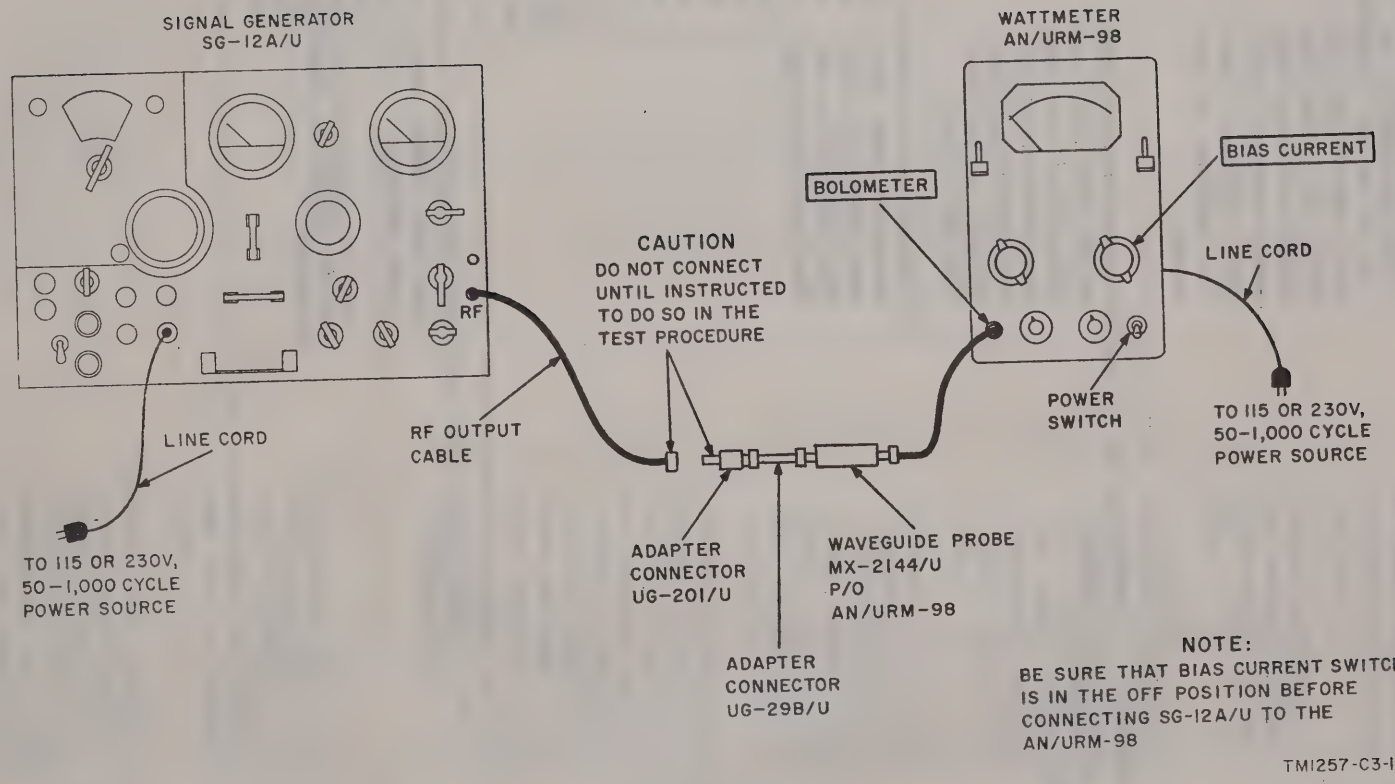


Figure 43.2. RF output test.

90.6 RF Output Test

connect the SG-12A/U to the AN/URM-98 (fig. 43.2) until instructed to do so in the test

a. Test Equipment and Materials.

		B. RF TUNING: 27 MEGACYCLES.	through *d*.	
4		RF TUNING: 39 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
5		BAND SWITCH: Band C. RF TUNING: 37 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
6		RF TUNING: 56 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
7		BAND SWITCH: Band D. RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
8		RF TUNING: 70 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
9		BAND SWITCH: Band E. RF TUNING: 66 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
10		RF TUNING: 102 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.

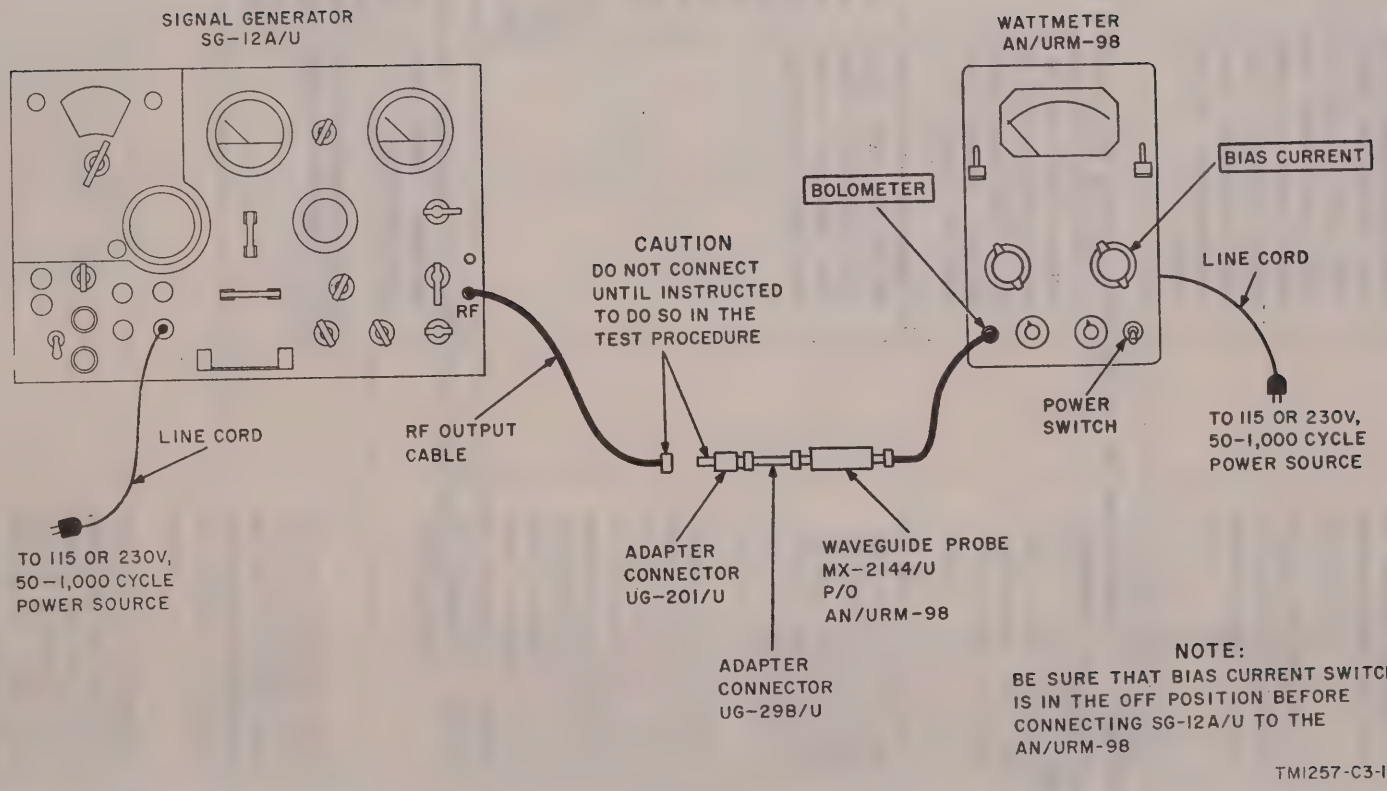


Figure 43.2. RF output test.

90.6 RF Output Test

a. Test Equipment and Materials.
Wattmeter AN/URM-98
Adapter Connector UG-29B/U
Adapter Connector UG-201/U

b. Test Connections and Conditions. Do not connect the SG-12A/U to the AN/URM-98 (fig. 43.2) until instructed to do so in the test procedures.

Caution: **Be sure that the BIAS CURRENT switch on the AN/URM-98 is in the OFF position before connecting UG-201/U to AN/URM-98.**

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*AN/URM-98* COEF. switch: NEG. RES. switch: 200. POWER RANGE: 10 MW−, +10 DBM. ZERO SET COARSE: Fully clockwise. ZERO SET FINE: Fully clockwise. BIAS CURRENT: 0-6 MA. Power: ON.	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES. RF ATTENUATOR MICROVOLTS: 10K. OPERATION: MOD OFF. POWER switch: ON.	*a.* Zero set the AN/URM-98; use the procedure in (1) or (2) below, whichever is applicable. (1) If the meter pointer is on scale or off scale at the high end, zero set the meter with the ZERO SET controls. Rotate the COARSE control counterclockwise until the pointer is close to zero; then rotate the FINE control counterclockwise until the pointer is at zero. (2) If the meter is off the scale at the low end, increase the BIAS CURRENT switch setting 1 step at a time until the pointer moves on scale or off scale at the high end. Zero set the meter with the ZERO SET controls as described in (1) above. *Note.* The AN/URM-98 may require as long as 1 hour to stabilize. During this period, the meter pointer may continually drift, which necessitates frequent readjustment of the ZERO SET controls.	*a.* None.
			b. Adjust the SG-12A/U RF SET TO LINE control for an RF SET TO LINE indication of the IF MICROVOLTS, RF SET TO LINE meter.	*b.* None.
			c. Readjust the AN/URM-98 ZERO SET controls for a zero indication on the meter then quickly connect the SG-12A/U RF output cable to the AN/URM-98 and note the immediate indication on the AN/URM-98 meter. *Note.* The procedure in *c* above must be performed quickly in order to obtain a reading before the AN/URM-98 drifts off ZERO SET. Repeat this procedure several times to insure that an accurate measurement has been made.	*c.* The immediate indication on the AN/URM-98 is between .375 and .625 on the 0.1 MILLIWATTS scale (.0375- .0625 milliwatts of power).
			d. Disconnect the SG-12A/U RF output cable at UG-201/U and continue to step No. 2.	*d.* None.
2		RF TUNING: 29 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
3		BAND SWITCH: Band B. RF TUNING: 27 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
4		RF TUNING: 39 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
5		BAND SWITCH: Band C. RF TUNING: 37 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
6		RF TUNING: 56 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
7		BAND SWITCH: Band D. RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
8		RF TUNING: 70 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
9		BAND SWITCH: Band E. RF TUNING: 66 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.
10		RF TUNING: 102 MEGACYCLES.	Repeat step No. 1*b* through *d*.	Same as step No. 1.

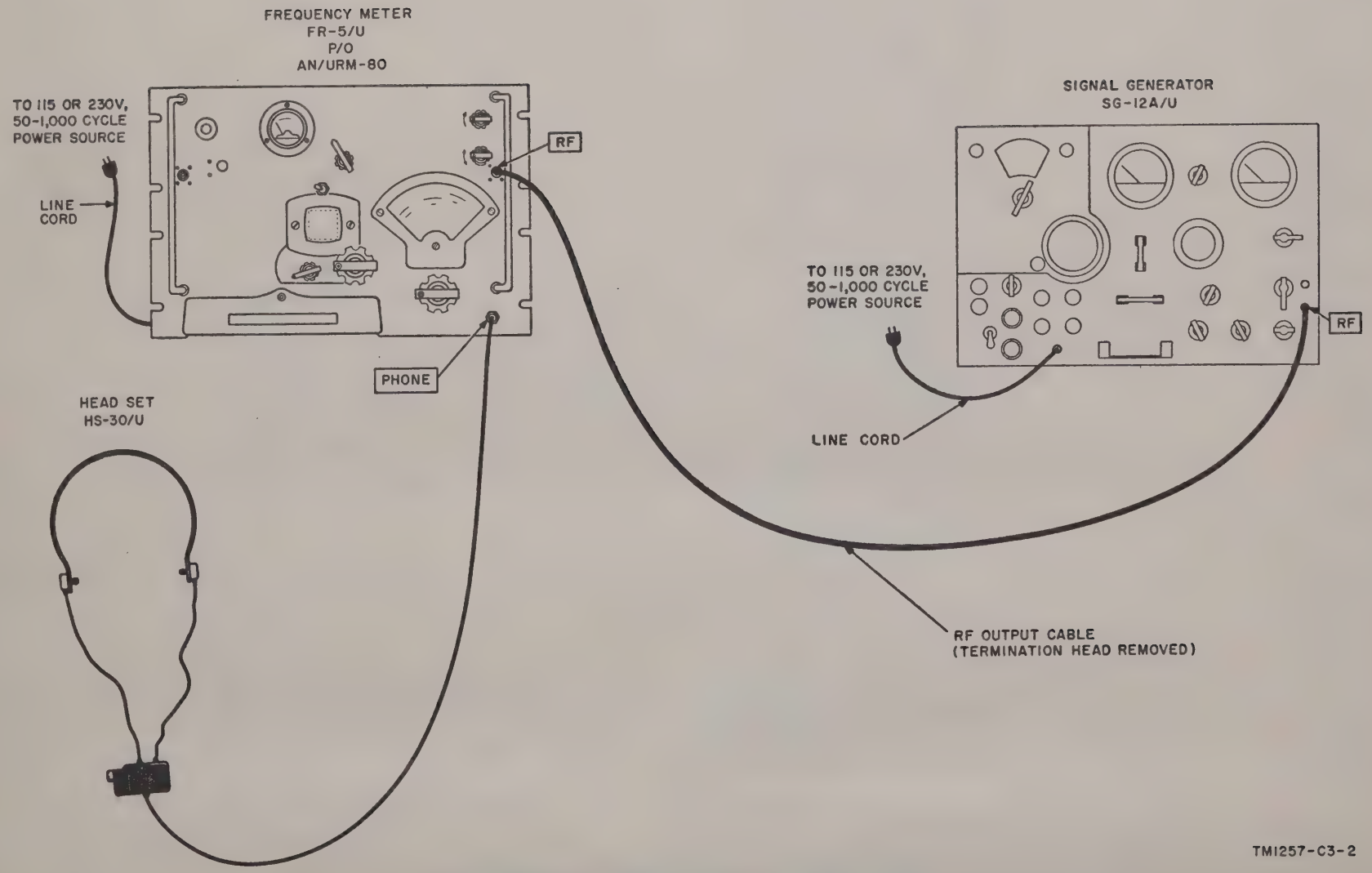


Figure 43.3. RF oscillator frequency calibration check.

9	Same as step No. 8.	RF TUNING: 56 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 55.9832–56.0168 megacycles.
10	Same as step No. 8.	BAND SWITCH: Band D. RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 45.9862–46.0138 megacycles.
11	Same as step No. 8.	RF TUNING: 58 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 57.9826–58.0174 megacycles.
12	Same as step No. 8.	RF TUNING: 70 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 69.9790–70.0210 megacycles.
13	Same as step No. 8.	BAND SWITCH: Band E. RF TUNING: 66 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 65.9780–66.0220 megacycles.
14	Same as step No. 8.	RF TUNING: 84 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 83.9748–84.0252 megacycles.
15	Same as step No. 8.	RF TUNING: 100 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 99.9700–100.0300 megacycles.

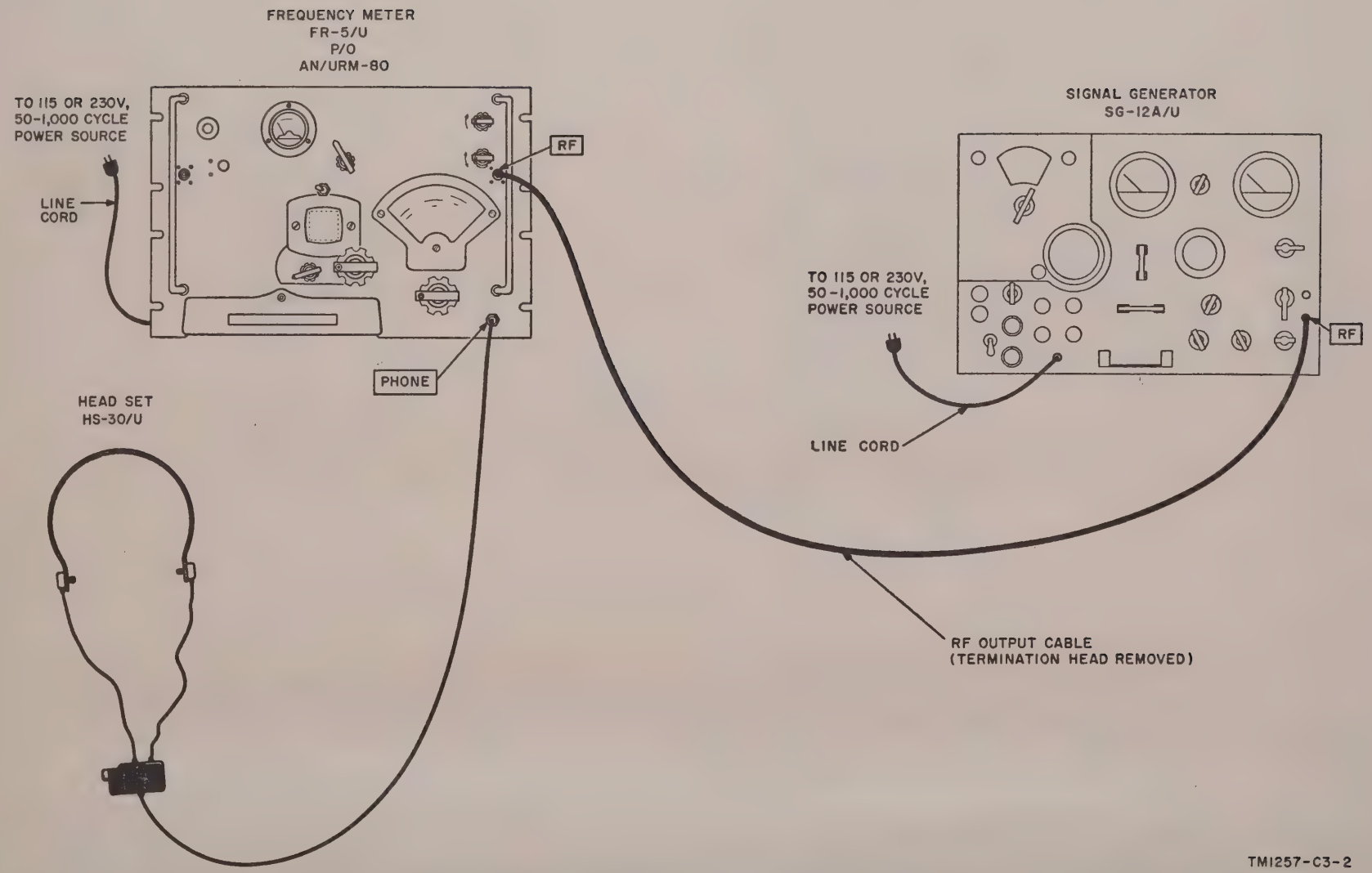


Figure 43.3. RF oscillator frequency calibration check.

90.7. RF Oscillator Frequency Calibration Check

a. Test Equipment and Materials.
Frequency Meter AN/URM–80
Headset HS–30/U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.3 After turning on the AN/URM–80 and SG–12A/U, allow a minimum of 20-minute warm-up time before proceeding with the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*AN/URM–80* RANGE: 10–21.7 MC. FUNCTION SWITCH: COARSE. LEVEL control: Fully clockwise. POWER switch: ON (toggle switch to the right).	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES. RF ATTENUATOR MICROVOLTS: 10K. OPERATION: MOD OFF. POWER switch: ON.	*a.* Make the following preliminary adjustments of the SG–12A/U controls: (1) Adjust the RF SET TO LINE control for the SET TO LINE Indication on the IF MICROVOLTS, RF SET TO LINE meter. (2) Set the OPERATION switch to CAL. (3) Adjust the CORRECTOR control for a zero beat indication from the loudspeaker in the front panel. (4) Set the OPERATION switch to MOD OFF. *b.* Using the *instructions of unknown frequency* on page 23 of the AN/URM–80 calibration book, measure the frequency of SG–12A/U output.	*a.* None. *b.* The output frequency of the SG–12A/U is within 19.9940–20.0060 megacycles.
2	*AN/URM–80* RANGE: 21.7–46.7 MC. FUNCTION SWITCH: COARSE. LEVEL control: Fully clockwise. POWER switch: ON.	RF TUNING: 24 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 23.9928–24.0072 megacycles.
3	Same as step No. 2.	RF TUNING: 28 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 27.9916–28.0084 megacycles.
4	Same as step No. 2.	BAND SWITCH: Band B. RF TUNING: 27 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 26.9919–27.0081 megacycles.
5	Same as step No. 2.	RF TUNING: 33 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 32.9901–33.0099 megacycles.
6	Same as step No. 2.	RF TUNING: 39 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 38.9883–39.0117 megacycles.
7	Same as step No. 2.	BAND SWITCH: Band C. RF TUNING: 38 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 37.9886–38.0114 megacycles.
8	*AN/URM–80* RANGE: 46.7–100 MC. FUNCTION SWITCH: COARSE. LEVEL control: Fully clockwise. POWER switch: ON.	RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 46.9859–47.0141 megacycles.
9	Same as step No. 8.	RF TUNING: 56 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 55.9832–56.0168 megacycles.
10	Same as step No. 8.	BAND SWITCH: Band D. RF TUNING: 46 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 45.9862–46.0138 megacycles.
11	Same as step No. 8.	RF TUNING: 58 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 57.9826–58.0174 megacycles.
12	Same as step No. 8.	RF TUNING: 70 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 69.9790–70.0210 megacycles.
13	Same as step No. 8.	BAND SWITCH: Band E. RF TUNING: 66 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 65.9780–66.0220 megacycles.
14	Same as step No. 8.	RF TUNING: 84 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 83.9748–84.0252 megacycles.
15	Same as step No. 8.	RF TUNING: 100 MEGACYCLES.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 99.9700–100.0300 megacycles.

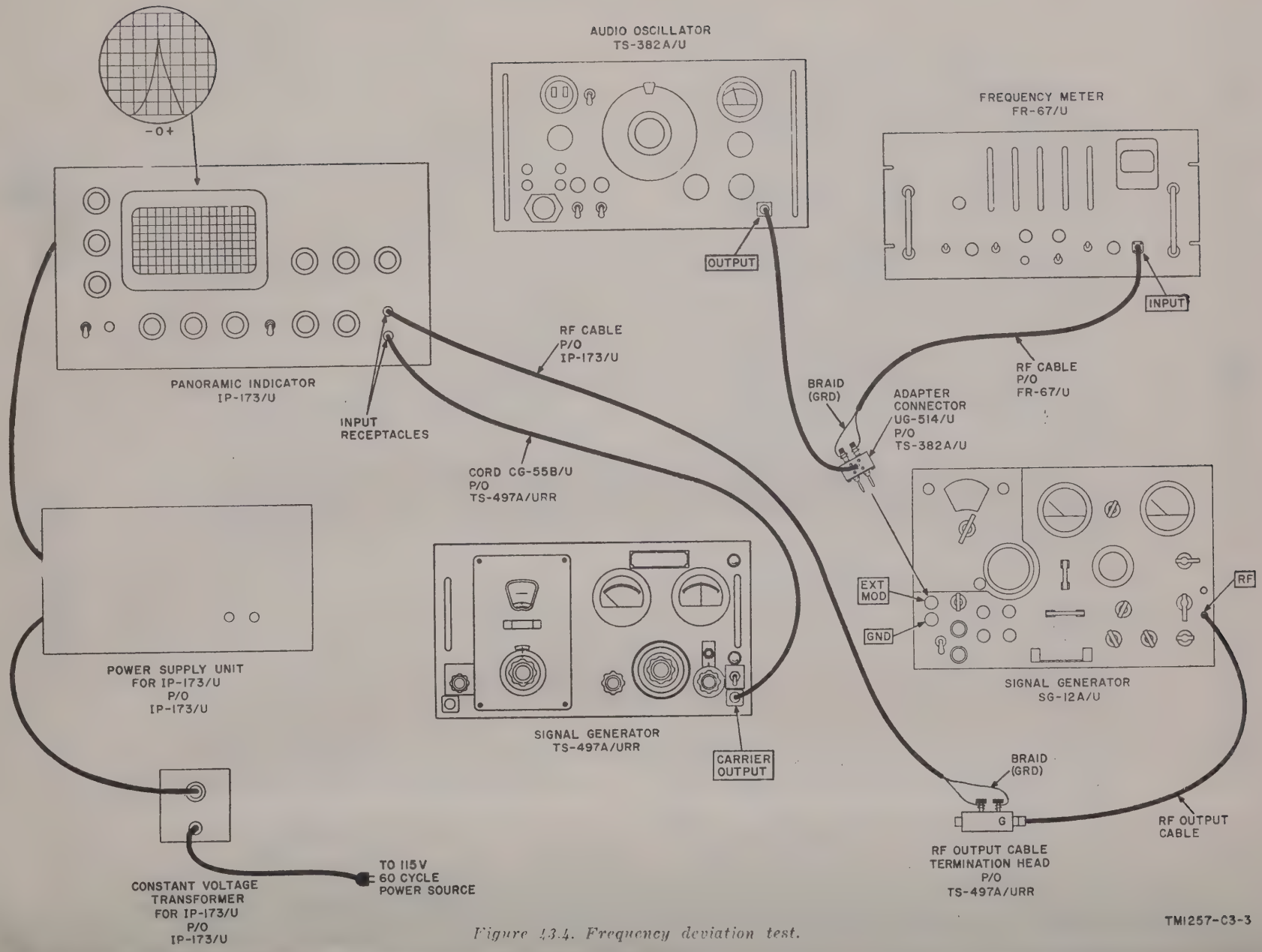


Figure 43.4. Frequency deviation test.

90.8. Frequency Deviation Test

a. Test Equipment and Materials.

Signal Generator TS–497(A)/URR
Frequency Meter FR–67/U

b. Test Connections and Conditions. Connect

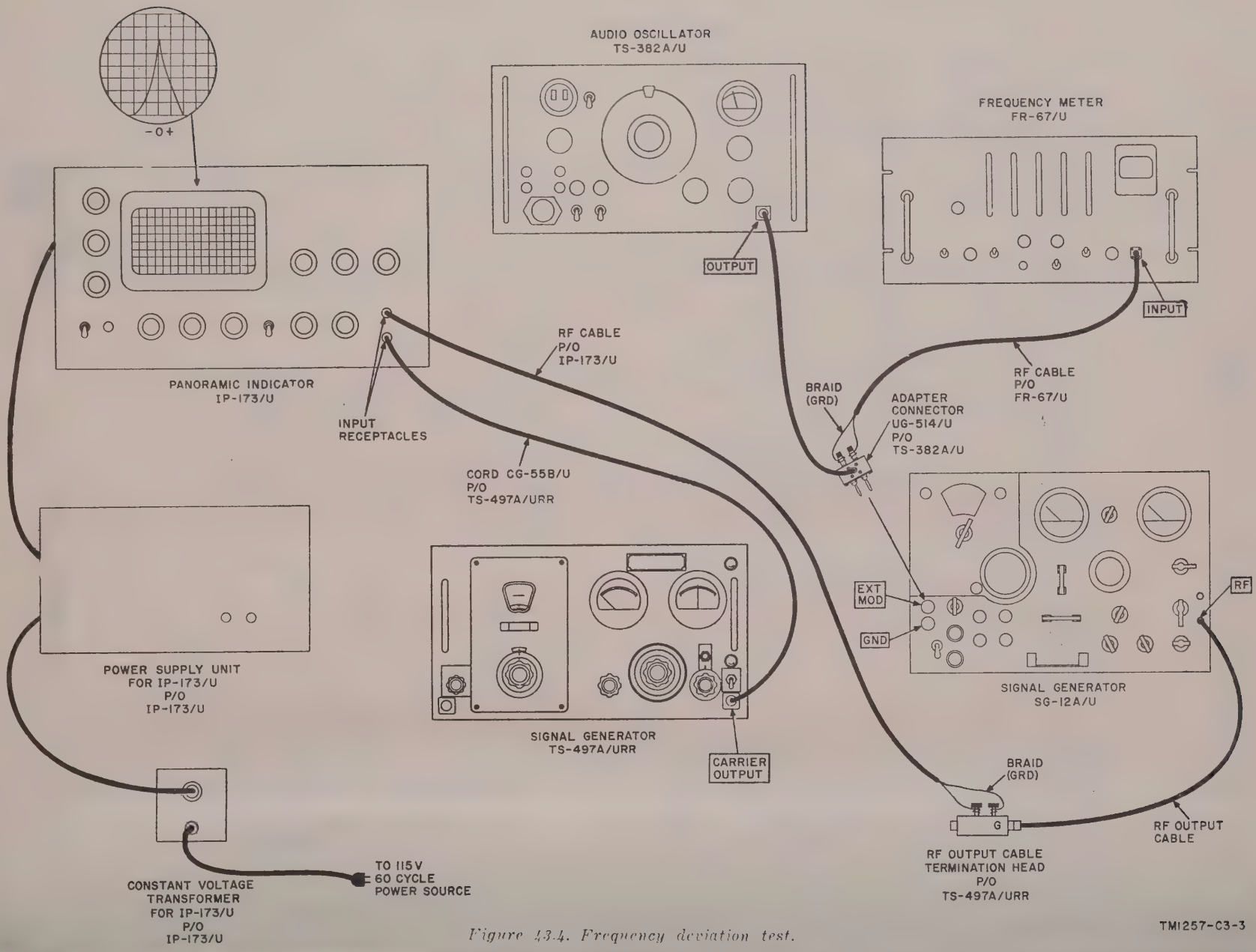


Figure 43.4. Frequency deviation test.

90.8. Frequency Deviation Test

a. Test Equipment and Materials.
Panoramic Indicator IP-173 U
Audio Oscillator TS-382(A) U
Signal Generator TS-497(A)/URR
Frequency Meter FR-67 U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.4.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IP-173/U* SWEEP RATE SELECTOR: 30. SCALE SELECTOR: LIN. VIDEO FILTER: in (UP). INTENSIFIER: Fully counterclockwise. RESOLUTION: 0.1. SWEEP WIDTH: 0.1. CENTER FREQ: mid-position. GAIN: 5. POWER switch: ON. *TS-382A/U* RANGE SWITCH: X100. ATTENUATOR: 10. OUTPUT LEVEL control: Fully clockwise. Main tuning dial: 62.5. OSC: ON. *TS-497A/URR* Range knob; Band C. Tuning dial: 20 MEGACYCLES. Carrier output attenuator (MICROVOLTS): 30K. POWER switch: ON. *FR-67/U* MEASURE-CHECK switch: MEASURE. EXT. START-INT. START: INT. START. AUTO-MANUAL: AUTO. MULTIPLY FREQUENCY BY: 1. DISPLAY TIME: Fully counterclockwise. POWER switch: ON.	BAND SWITCH: Band A. RF TUNING: 25 MEGACYCLES. OPERATION: EXT MOD. DEVIATION RANGE: 25. DEVIATION LEVEL: Fully counterclockwise. RF ATTENUATOR MICROVOLTS: 10K. POWER switch: ON.	*a.* Adjust the RF SET TO LINE control on SG-12A/U for a red line indication on the IF MICROVOLTS, RF SET TO LINE meter. *b.* Adjust the ring fiducial on the TS-497A/URR for a SET TO RED LINE indication on the OUTPUT meter. *c.* Adjust the FR-67/U SENSITIVITY control until the INPUT LEVEL meter pointer lies in the green sector of the meter scale. *d.* Adjust the TS-382A/U main tuning dial in the vicinity of 62.5 until the FR-67/U meter displays a count of 6,250 ± cycle. *e.* Adjust the BRILLIANCE and FOCUS controls on the IP-173/U until a well defined trace extending across the bottom of the score face is seen. *f.* Adjust the tuning dial of TS-497A/URR and the GAIN control of the IP-173/U until a waveform similar to that shown in figure 43.4 appears on the IP-173/U scope face. *Note.* Slight adjustment of the IP-173/U SWEEP WIDTH and RESOLUTION controls may be necessary to achieve the desired results. *g.* While closely observing the waveform, slowly turn the DEVIATION LEVEL control on SG-12A/U clockwise until the waveform pip disappears for the first time (carrier null). Note the indication on the KILOCYCLES DEVIATION meter. *Note.* Disregard the sideband waveforms that appear at either side as the center frequency waveform diminishes in amplitude.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* None. *g.* The KILOCYCLES DEVIATION meter indicates within 12–18 kc on the 0–25 scale of KILOCYCLES DEVIATION meter.
2	*TS-382A/U* Main tuning dial: 46.4.	DEVIATION RANGE: 50. DEVIATION LEVEL: Fully counterclockwise. *Note.* Do not disturb other controls.	*a.* Adjust the audio oscillator main tuning dial in the vicinity of 46.4 until the FR-67/U displays a count of 4,640 ± 1 cycle. *b.* While closely observing the waveforms on the scope face of the IP-173/U, slowly turn the deviation level control on, SG-12A/U clockwise until the waveform disappears (carrier nulls) for the *third time*.	*a.* None. *b.* The KILOCYCLES DEVIATION meter indicates within 32–48 kc on the 0–50 scale of the KILOCYCLE DEVIATION meter.
3	*TS-382A/U* Main tuning dial: 35.4.	DEVIATION RANGE: 100. DEVIATION LEVEL: Fully counterclockwise.	*a.* Adjust the audio oscillator main tuning dial in the vicinity of 35.4 until the FR-67/U displays a count of 3,537 ± 1 cycle. *b.* While closely observing the waveform on the scope face of the IP-173/U, slowly turn the DEVIATION LEVEL control on the SG-12A/U clockwise until the waveform disappears (carrier nulls) for the *seventh* time.	*a.* None. *b.* The KILOCYCLES DEVIATION meter indicates within 60–90 kc on the 0–100 scale of the KILOCYCLE DEVIATION meter.
4	*TS-497A/URR* Tuning dial: 28 MEGACYCLES. *Note.* Do not disturb any other controls.	BAND SWITCH: Band B. RF TUNING: 33 MEGACYCLES. DEVIATION LEVEL: Fully counterclockwise.	*a.* Adjust the RF SET TO LINE control on the SG-12A/U for a red line indication on its IF MICROVOLTS, RF SET TO LINE meter. *b.* Adjust the ring fiducial on the TS-497A/URR for a red line indication on its OUTPUT meter. *c.* Adjust the tuning dial of the TS-497A/URR until a waveform similar to that shown in figure 43.4 appears on the IP-173/U scope face. *d.* While closely observing the waveform on the scope face of the IP-173/U, slowly turn the DEVIATION LEVEL control on the SG-12A/U clockwise until the waveform disappears (carrier nulls) for the *seventh* time.	*a.* None. *b.* None. *c.* None. *d.* Same as step No. 3*b*.
5	*TS-497A/URR* Range knob: Band D. Tuning dial: 40 MEGACYCLES. *Note* Do not disturb any other controls.	*a.* BAND SWITCH: Band C. *b.* RF TUNING: 45 MEGACYCLES. *c.* DEVIATION LEVEL: Fully counterclockwise.	Repeat step No. 4*a* through *d*.	Same as step No. 3*b*.
6	*TS-497A/URR* Tuning dial: 53 MEGACYCLES. *Note* Do not disturb any other controls.	BAND SWITCH: Band D. RF TUNING: 58 MEGACYCLES. DEVIATION LEVEL: Fully counterclockwise.	Repeat step No. 4*a* through *d*.	Same as step No. 3*b*.
7	*TS-497A/URR* Range knob: Band E. Tuning dial: 79 MEGACYCLES. *Note* Do not disturb any other controls.	BAND SWITCH: Band E. RF TUNING: 84 MEGACYCLES. DEVIATION LEVEL: Fully counterclockwise.	Repeat step No. 4*a* through *d*.	Same as step No. 3*b*.
8		OPERATION: 1000~. DEVIATION LEVEL: Fully counterclockwise.	Turn the DEVIATION LEVEL control on the SG-12A/U clockwise as far as it will go and note the indication on the KILOCYCLES DEVIATION meter.	The KILOCYCLES DEVIATION meter indicates not less than full scale.

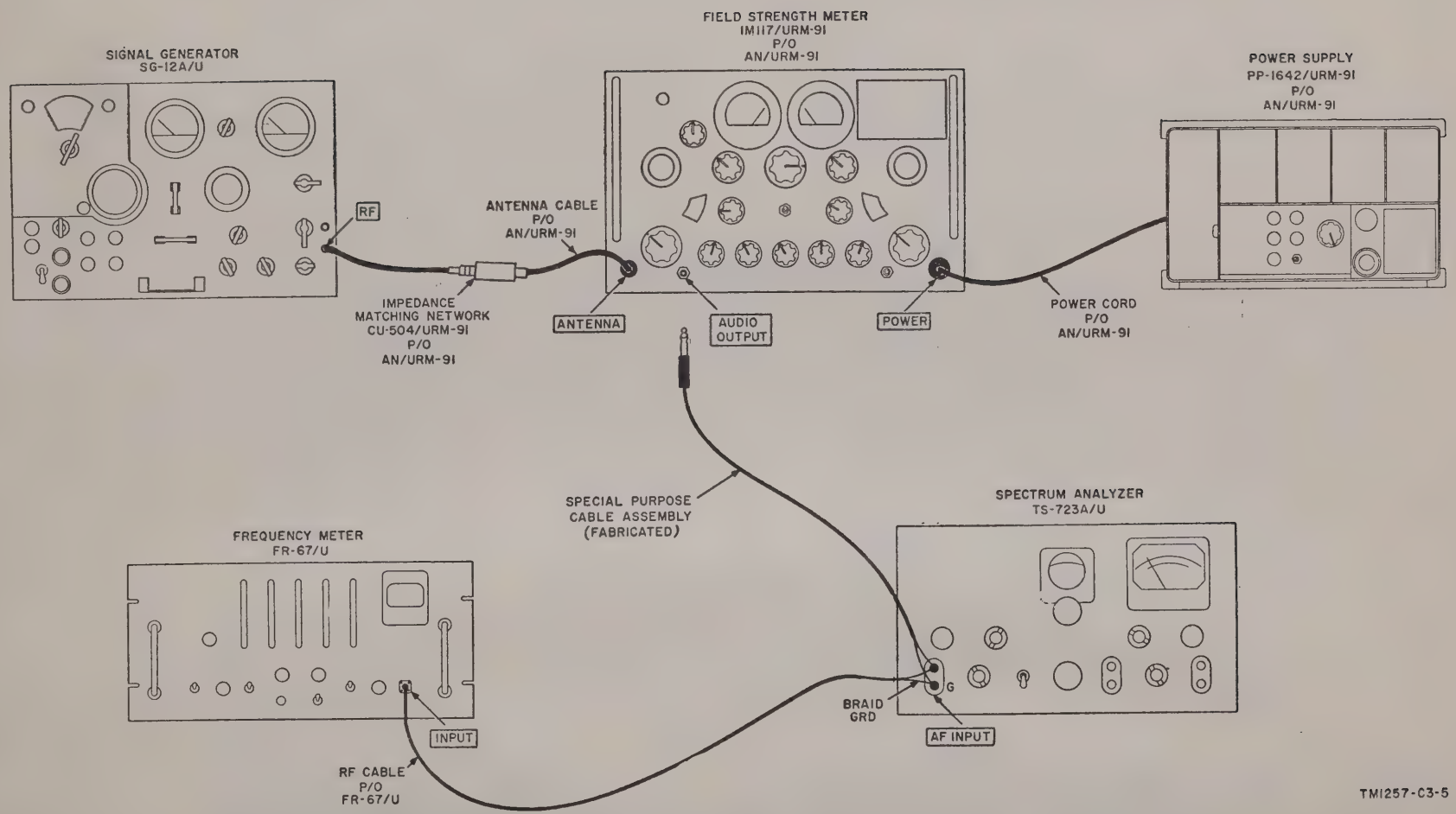


Figure 43.5. Modulation distortion and internal modulation frequency test.

90.9. Modulation Distortion and Internal Modulation Frequency Test

a. Test Equipment and Materials.

Special purpose cable assembly (fabricated) (fig. 43.1)

b. Test Connection and Conditions.

(1) Connect the equipment as shown in

			URM–91 RF TRIMMER for a peak indication on the signal level meter.	
			e. Adjust the FR–67/U SENSITIVITY control until the pointer of the INPUT LEVEL meter lies in the green sector of the meter scale. Note the average count displayed.	*e.* The FR–67/U should indicate within 950–1,050 cycles.
Z	*Note.* Do not disturb any control settings except as indicated in the *Test procedure* column.	*Note.* Do not disturb any control settings.	*a.* Adjust the TS–723A/U signal INPUT control for a full scale indication on the panel meter (0–1.0 r.m.s. VOLTS scale).	*a.* None.
			b. Set the TS–723A/U function switch to DISTORTION and adjust the FREQUENCY controls (coarse and fine) for a minimum indication on the panel meter.	*b.* None.
			c. Adjust the TS–723A/U BALANCE control for a minimum indication on the panel meter; then note the panel meter indication (0–1.0 r.m.s. VOLTS scale).	*c.* The TS–723A/U panel meter should indicate not more than 0.05 (0–1.0 r.m.s. VOLTS scale) (5% distortion).

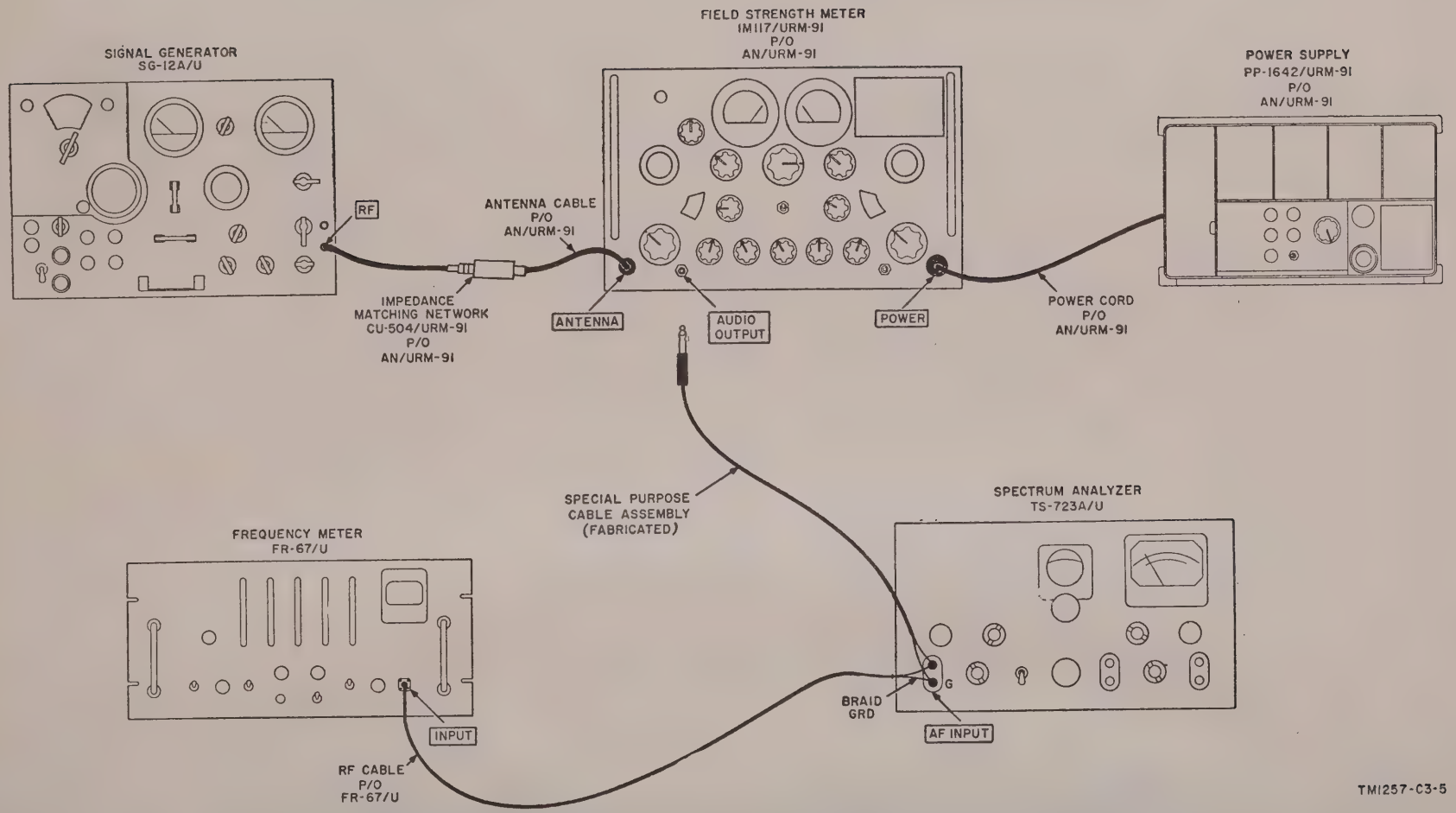


Figure 43.5. Modulation distortion and internal modulation frequency test.

90.9. Modulation Distortion and Internal Modulation Frequency Test

a. Test Equipment and Materials.

Field Strength Meter IM–117/URM–91 (p/o AN/URM–91) or TS–579/URR
Spectrum Analyzer TS–723(A)/U
Frequency Meter FR–67/U
Special purpose cable assembly (fabricated) (fig. 43.1)

b. Test Connection and Conditions.

(1) Connect the equipment as shown in figure 43.5.

(2) Place the TM–117/URM–91 power switch in START position and allow a 1-minute warmup period.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IM–117/URM–91* RECEIVER BAND SELECTOR: 18–35. RECEIVER FREQUENCY MEGACYCLES: 20. RESPONSE: BROAD. GAIN: 0. DB ATTENUATOR: 40. OUTPUT: LIN. CALIBRATE SWITCH: FIL. FM DISCRIMINATOR: ON. POWER switch: ON. *TS–723A/U* INPUT: MIN. AF–RF selector switch: AF. RANGE switch: X10. Function switch: SET LEVEL. Meter range switch: 100%. Power switch: ON. *FR–67/U* SENSITIVITY: Fully counterclockwise. MEASURE-CHECK: MEASURE. EXT. START-INT. START: INT. START. DISPLAY TIME: Fully counterclockwise. AUTO-MANUAL: AUTO. MULTIPLY FREQUENCY BY: 1. POWER switch: ON.	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES. OPERATION: 1000—. RF ATTENUATOR MICROVOLTS: 1K. DEVIATION RANGE: 100. POWER Switch: On.	*a.* Make the following preliminary adjustments of the SG–12A/U controls: (1) Adjust the DEVIATION LEVEL control for a full scale indication on the KILOCYCLES DEVIATION meter. (2) Adjust the RF SET TO LINE control for a red line indication on the IF MICROVOLTS, RF SET TO LINE meter.	*a.* None.
			b. Make the following preliminary adjustments of the IM–117/URM–91 (or TS–579/U) controls. *Note.* If the TS–579/U is used in place of the IM–117/URM–91, corresponding controls and indicators are to be used. (1) Adjust the VOLTAGE ADJUSTMENT control on Power Supply PP–1642/URM–91 for a red line indication on the calibration meter. (2) Push the ZERO toggle switch down and adjust the ZERO START control for a zero indication on the signal level meter (MICROVOLTS scale). (3) While still holding the ZERO toggle switch down, turn the POWER switch knob to ON position and adjust the ZERO ON control for a zero indication on the signal level meter (MICROVOLTS scale). (4) Release the ZERO toggle switch and turn the CALIBRATE SWITCH knob to the OFF position.	*b.* None.
			c. Set the IM–117/URM–91 meter GAIN control to 5 and adjust the RECEIVER FREQUENCY MEGACYCLES control for a peak indication on signal level meter. *Note.* Adjust the IM–117/URM–91 GAIN control as required to keep the signal level meter pointer on scale.	*c.* None.
			d. Adjust the IM–117/URM–91 RF TRIMMER for a peak indication on the signal level meter.	*d.* None.
			e. Adjust the FR–67/U SENSITIVITY control until the pointer of the INPUT LEVEL meter lies in the green sector of the meter scale. Note the average count displayed.	*e.* The FR–67/U should indicate within 950–1,050 cycles.
2	*Note.* Do not disturb any control settings except as indicated in the *Test procedure* column.	*Note.* Do not disturb any control settings.	*a.* Adjust the TS–723A/U signal INPUT control for a full scale indication on the panel meter (0–1.0 r.m.s. VOLTS scale).	*a.* None.
			b. Set the TS–723A/U function switch to DISTORTION and adjust the FREQUENCY controls (coarse and fine) for a minimum indication on the panel meter.	*b.* None.
			c. Adjust the TS–723A/U BALANCE control for a minimum indication on the panel meter; then note the panel meter indication (0–1.0 r.m.s. VOLTS scale).	*c.* The TS–723A/U panel meter should indicate not more than 0.05 (0–1.0 r.m.s. VOLTS scale) (5% distortion).

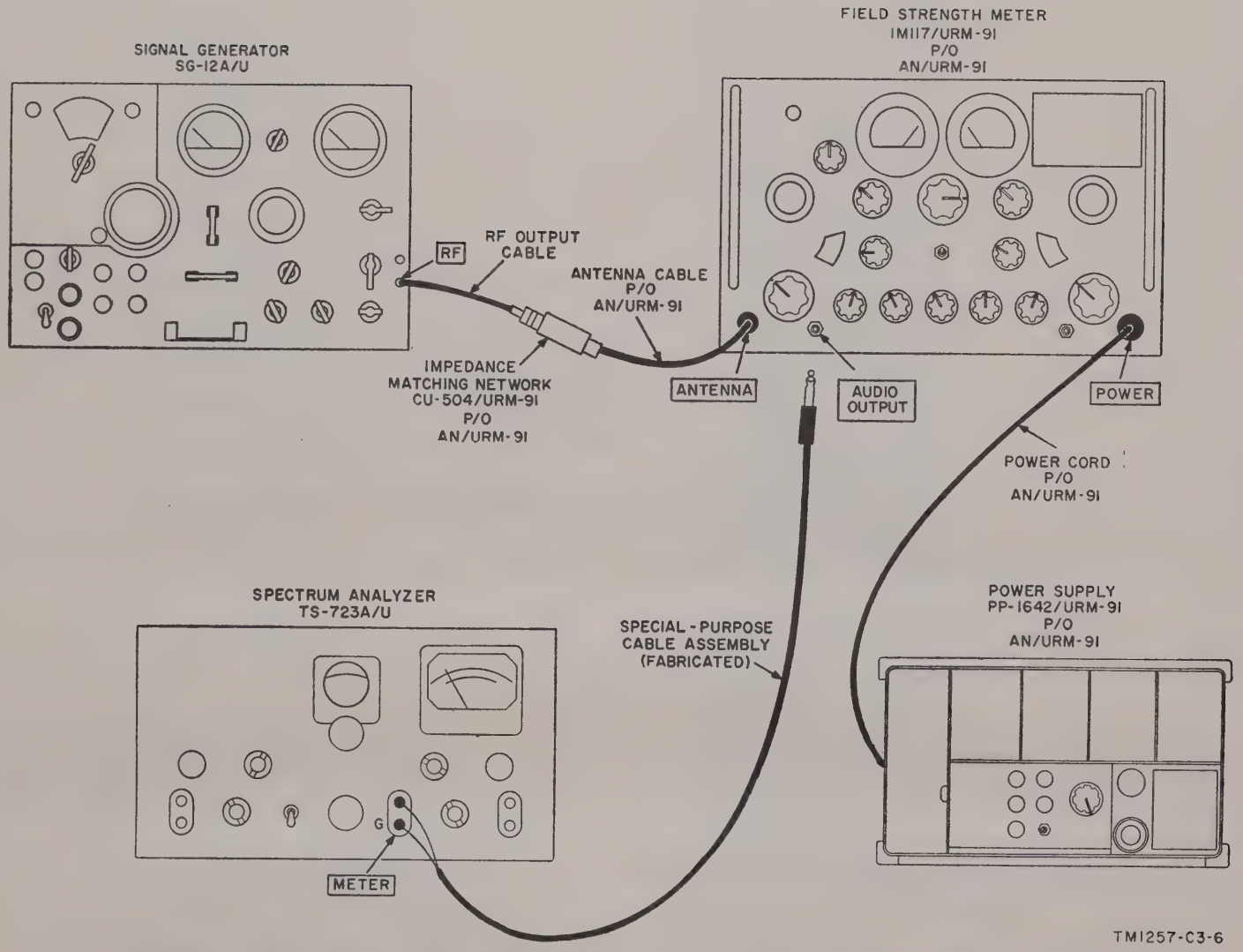


Figure 43.6. Noise test.

90.10. Noise Test

a. Test Equipment and Materials. Field Strength Meter IM–117/URM–91 (p/o AN/URM–91) or TS–579/U

Spectrum Analyzer TS–723A/U

Special purpose cable assembly (fabricated) (fig. 43.1)

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.6.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IM–117/URM–91* *Note.* If the TS–579/U is used in place of the IM–117/URM–91, corresponding controls and indicators are to be used.	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES.	*a.* Make the following preliminary adjustments of the SG–12A/U controls: (1) Adjust the DEVI-	*a.* None.
			Note. Adjust the GAIN control as required to keep the signal level meter pointer on scale.	
			d. Adjust the IM–117/-URM–91 RF TRIMMER for a peak indication on the signal level meter.	*d.* None.
			e. Adjust the IM–117/-URM–91 GAIN control for a zero indication on the TS–723A/U panel meter DECIBELS scale.	*e.* None.
			f. Set the SG–12A/U OPERATION switch to MOD OFF and the TS–723A/U meter range switch to —30 DB. Note the indication on the TS–723A/U panel meter.	*f.* The TS–723A/U panel meter should indicate 0 or to the left of 0 on the scale (at least –50 DB).

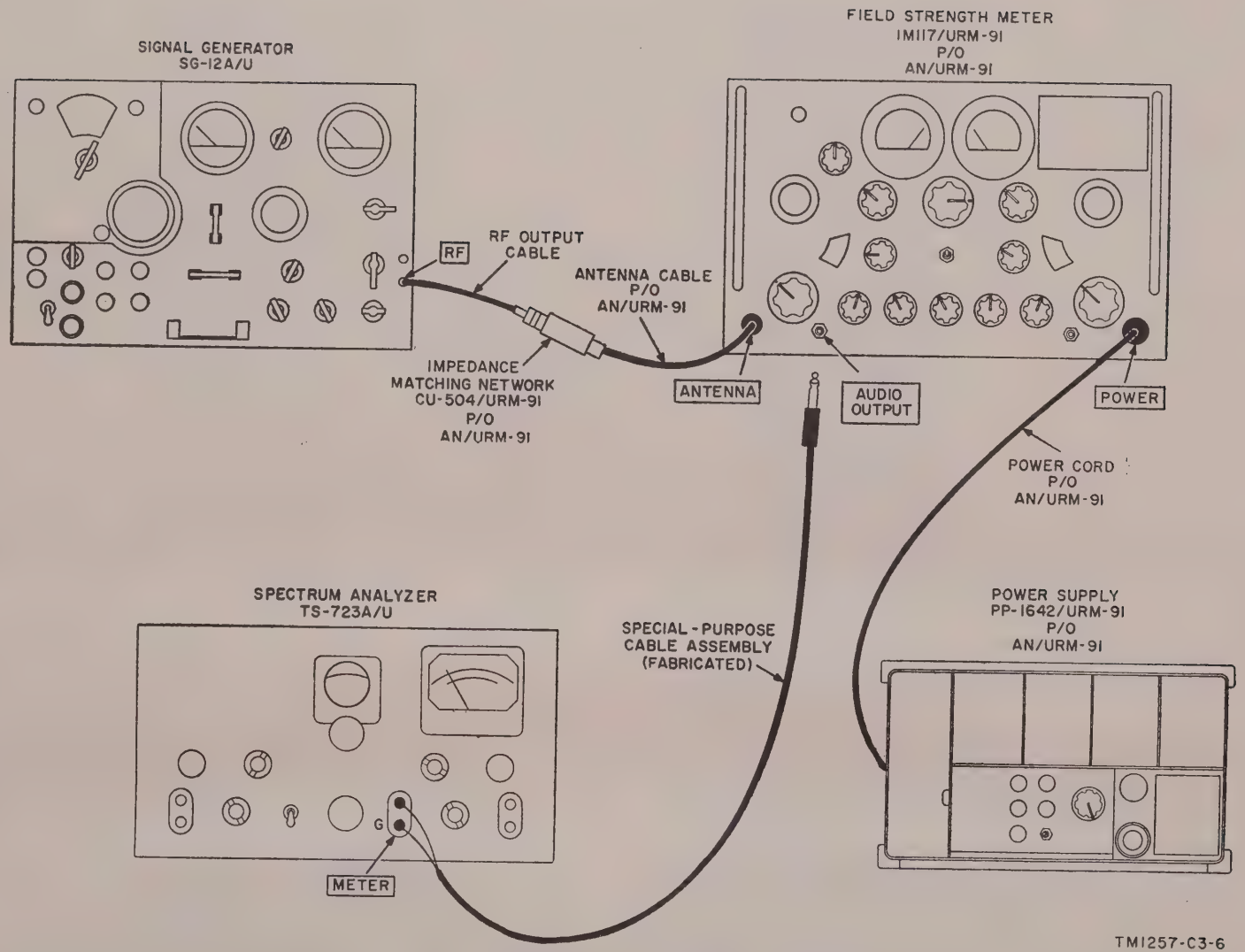


Figure 43.6. Noise test.

90.10. Noise Test

a. Test Equipment and Materials. Field Strength Meter IM–117/URM–91 (p/o AN/URM–91) or TS–579/U
Spectrum Analyzer TS–723A/U
Special purpose cable assembly (fabricated) (fig. 43.1)

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.6.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*IM–117/URM–91* *Note.* If the TS–579/U is used in place of the IM–117/URM–91, corresponding controls and indicators are to be used. RECEIVER BAND SELECTOR: 18–35. RECEIVER FREQUENCY MEGACYCLES: 20. RESPONSE: SHARP. GAIN: 0. OUTPUT: LIN. DB ATTENUATOR: 40. CALIBRATE SWITCH: FIL. FM DISCRIMINATOR: ON. POWER: switch: START. *TS–723A/U* Function switch: METER. Meter range switch +20 DB.	BAND SWITCH: Band A. RF TUNING: 20 MEGACYCLES. OPERATION: 1000—. RF ATTENUATOR MICROVOLTS: 10K. DEVIATION RANGE: 25. POWER switch: ON.	*a.* Make the following preliminary adjustments of the SG–12A/U controls: (1) Adjust the DEVIATION LEVEL control for an indication of 15 on the KILOCYCLES DEVIATION meter (0–25 scale). (2) Adjust the RF SET TO LINE control for a red line indication on the IF MICROVOLTS, RF SET TO LINE meter.	*a.* None.
			b. Make the following preliminary adjustment of the IM–117/URM–91 meter controls: (1) Adjust the VOLTAGE control on the Power Supply PP–1642/URM–91 for a red line indication on the calibration meter. (2) Push the ZERO toggle switch down and adjust the ZERO START control for a zero indication on the signal level meter (MICROVOLTS scale). (3) While still holding the ZERO toggle switch down, turn the POWER switch knob to the ON position and adjust the ZERO ON control for zero indication on the signal level meter (MICROVOLTS scale). (4) Release the ZERO toggle switch and turn the CALIBRATE SWITCH knob to the OFF position.	*b.* None.
			c. Set the IM–117/URM–91 GAIN control to 5 and adjust the RECEIVER FREQUENCY MEGACYCLES control for a peak indication on the signal level meter. *Note.* Adjust the GAIN control as required to keep the signal level meter pointer on scale.	*c.* None.
			d. Adjust the IM–117/URM–91 RF TRIMMER for a peak indication on the signal level meter.	*d.* None.
			e. Adjust the IM–117/URM–91 GAIN control for a zero indication on the TS–723A/U panel meter DECIBELS scale.	*e.* None.
			f. Set the SG–12A/U OPERATION switch to MOD OFF and the TS–723A/U meter range switch to —30 DB. Note the indication on the TS–723A/U panel meter.	*f.* The TS–723A/U panel meter should indicate 0 or to the left of 0 on the scale (at least –50 DB).

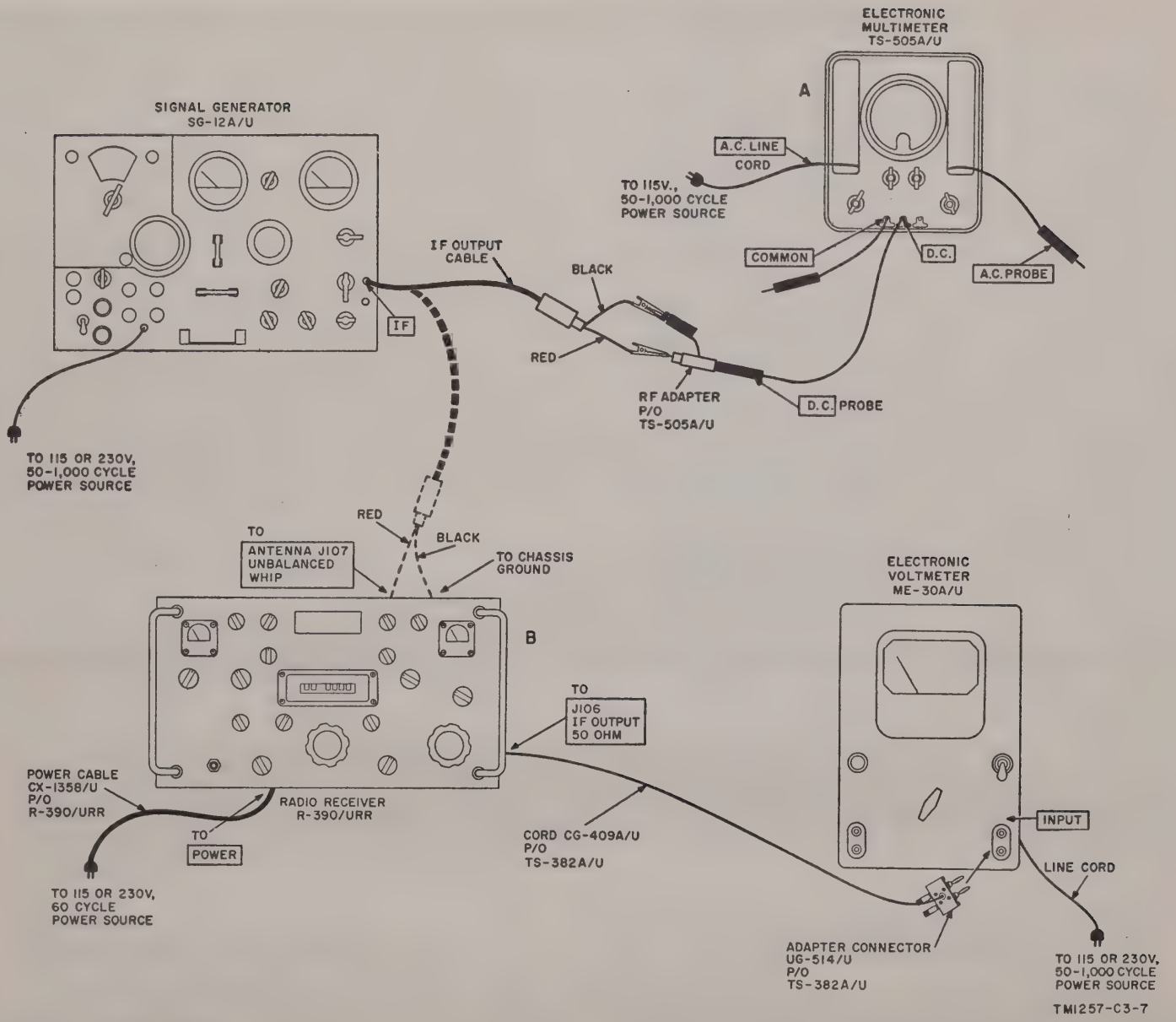


Figure 43.7. IF oscillator output and attenuator test.

90.11. IF Oscillator Output and Attenuator Test

a. Test Equipment and Materials.

b. Test Connections and Conditions. Do not connect either meter or Radio Receiver (fig

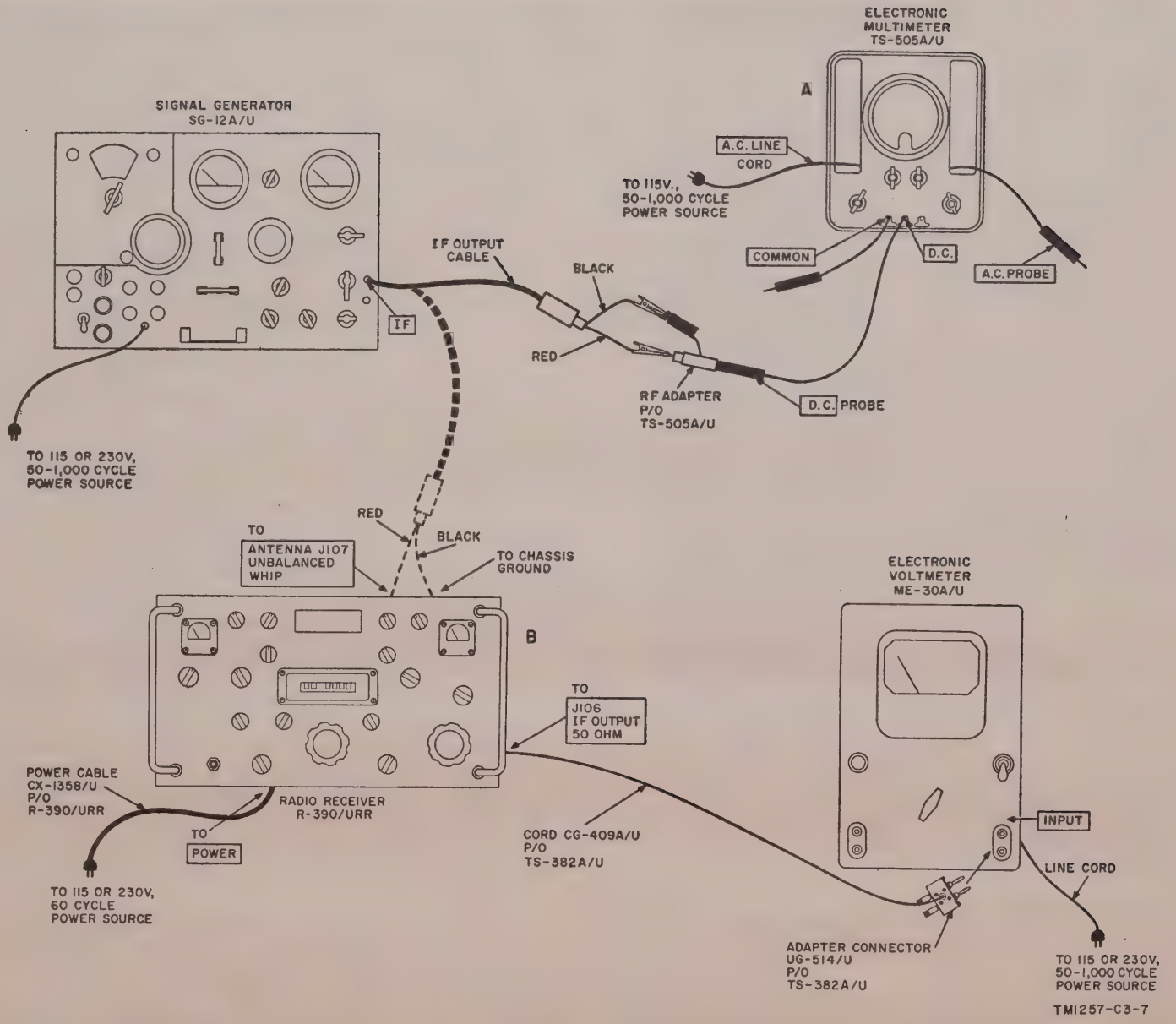


Figure 43.7. IF oscillator output and attenuator test.

90.11. IF Oscillator Output and Attenuator Test

a. Test Equipment and Materials.
Electronic Multimeter TS–505A/U
Electronic Voltmeter ME–30A/U

b. Test Connections and Conditions. Do not connect either meter or Radio Receiver (fig. 43.7) to the SG–12A/U output until instructed to do so in the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS–505A/U* FUNCTION switch: +dc RANGE switch: 2.5V RXI.	OPERATION: IF. IF MICROVOLTS: 1.0 VOLT. IF FREQUENCY MC: 1.37. POWER switch: ON.	*a.* Zero the TS–505A/U as follows: Short the dc and COMMON probe tips together and adjust the ZERO ADJ. control until the meter pointer indicates exactly 0 volt.	*a.* None.
			b. Separate the dc and COMMON probe tips and connect the TS–505A/U to the SG–12A/U output as shown in A, figure 43.7.	*b.* None.
			c. Adjust the SG–12A/U IF LEVEL control for an indication of 10 on the IF MICROVOLTS, RF SET TO LINE meter. Note the indication on the TS–505A/U.	*c.* TS–505A/U indicates within .75–1.25 volts.
2	Same as step No. 1.	IF FREQUENCY MC: 1.40.	Repeat step No. 1*c*.	Same as step No. 1*c*.
3	Same as step No. 1.	IF FREQUENCY MC: 1.43.	Repeat step No. 1*c*.	Same as step No. 1*c*.
4	Same as step No. 1.	IF FREQUENCY MC: 4 4.27.	Repeat step No. 1*c*.	Same as step No. 1*c*.
5	Same as step No. 1.	IF FREQUENCY MC: 4.30.	Repeat step No. 1*c*.	Same as step No. 1*c*.
6	Same as step No. 1.	IF FREQUENCY MC: 4.33.	Repeat step No. 1*c*.	Same as step No. 1*c*.
7	Same as step No. 1.	IF FREQUENCY MC: 4.45.	Repeat step No. 1*c*.	Same as step No. 1*c*.
8	Same as step No. 1.	IF FREQUENCY MC: 5.00.	Repeat step No. 1*c*.	Same as step No. 1*c*.
9	Same as step No. 1.	IF FREQUENCY MC: 5.35.	Repeat step No. 1*c*.	Same as step No. 1*c*.
10	Same as step No. 1.	IF FREQUENCY MC: 15.	Repeat step No. 1*c*.	Same as step No. 1*c*.
11	*ME–30A/U* Range selector switch: +10DB. POWER switch: ON. *R–390/URR* FUNCTION: MGC. BREAK IN: OFF. BFO: OFF. BANDWIDTH KC: 1. LIMITER: OFF. MEGACYCLE CHANGE: 01. KILOCYCLE CHANGE: 370.	IF FREQUENCY MC: 1.37. IF MICROVOLTS: 1.0 volt. OPERATION: IF. POWER switch: ON.	*a.* Reconnect the equipment as shown in B, figure 43.7.	*a.* None.
			b. Adjust the SG–12A/U IF LEVEL control for an indication of 10 on the IF MICROVOLTS, RF SET TO LINE meter.	*b.* None.
			c. Adjust the R–390/URR MEGACYCLES CHANGE control for a peak indication on the ME–30A/U meter. *Note.* If the meter pointer runs off scale, reduce the setting of the R–390/URR RF GAIN control to achieve mid-scale indication.	*c.* None.
	LOCAL GAIN: 0. RF GAIN: 3.		*d.* Adjust the R–390/URR ANT TRIM +control for a peak indication on the ME–30A/U.	*d.* None.
			e. Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter.	*e.* None.
			f. Set the SG–12A/U IF MICROVOLTS switch to 100K and the ME–30A/U range switch to –30DB. Note the indication on the ME–30A U meter.	*f.* The ME–30A U meter indicates 0 +1 on the DECIBELS scale.
12	*ME–30A/U* Range selector switch: –10DB.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter.	*a.* None.
			b. Set the SG–12A/U IF MICROVOLTS switch to 10K and the ME–30A U range switch to –30 DB. Note the indication on the ME–30A U meter.	*b.* Same as step No. 11*f*.
13	Same as step No. 12 above.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter.	*a.* None.
			b. Set the SG–12A/U IF MICROVOLTS switch to 1K and the ME–30A/U range switch to –30 DB. Note the indication on the ME–30A U meter.	*b.* Same as step No. 11*f* above.
14	Same as step No. 12 above.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A U meter.	*a.* None.
			b. Set the SG–12A U IF MICROVOLTS switch to 100 and the ME–30A U range switch to –30 DB. Note the indication on the ME–30A U meter.	*b.* Same as step No. 11*f*.
15	Same as step No. 12 above.		*a.* Adjust the R–390/URR RF GAIN control for a zero (0) indication on the ME–30A/U meter.	*a.* None.
			b. Set the SG–12A U IF MICROVOLTS switch to 10 and the ME–30A/U range switch to –30 DB. Note the indication on the ME–30A U meter.	*b.* Same as step No. 11*f*.

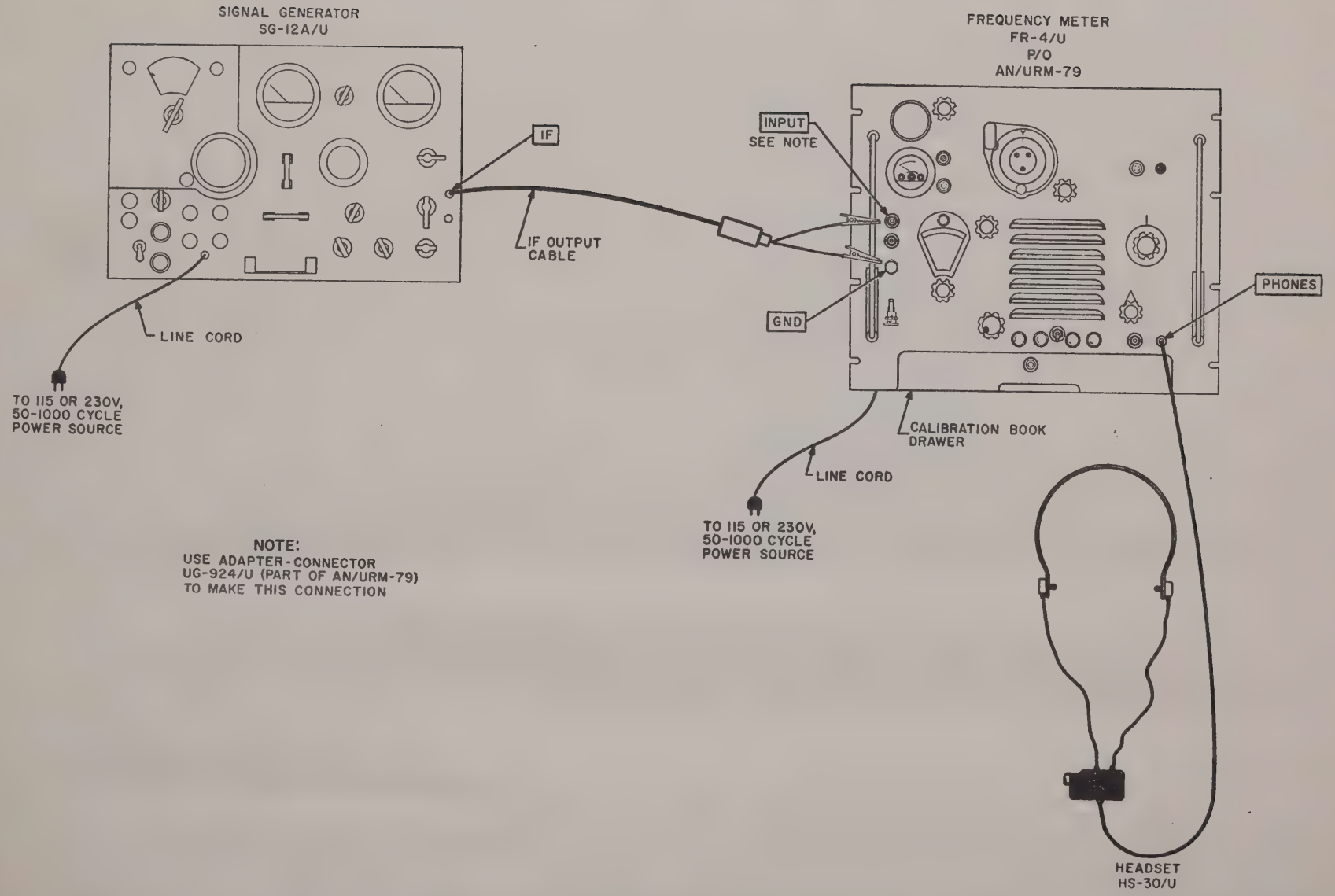


Figure 43.8. IF oscillator frequency calibration check

90.12. IF Oscillator Frequency Calibration Check

a. Test Equipment and Materials.

Frequency Meter FR–4/U (p/o AN/URM–79)

Headset HS–30/U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.8. After turning on the FR–4/U (p/o AN/URM–79), allow at least a 20-minute warmup time before proceeding with the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*FR–4/U* BAND SWITCH: Band 4	OPERATION: IF. IF FREQUENCY MC: 1.37	*a.* Adjust the SG–12A/U IF LEVEL control for an indication of 10 on	*a.* None.
9	*FR–4/U* BAND SWITCH: Band 6. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 5.35.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 5,349,-723 – 5,350,268 cycles.
10	*FR–4/U* BAND SWITCH: Band 7. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 15.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within the 14,-999,250 – 15,000,750 cycles.

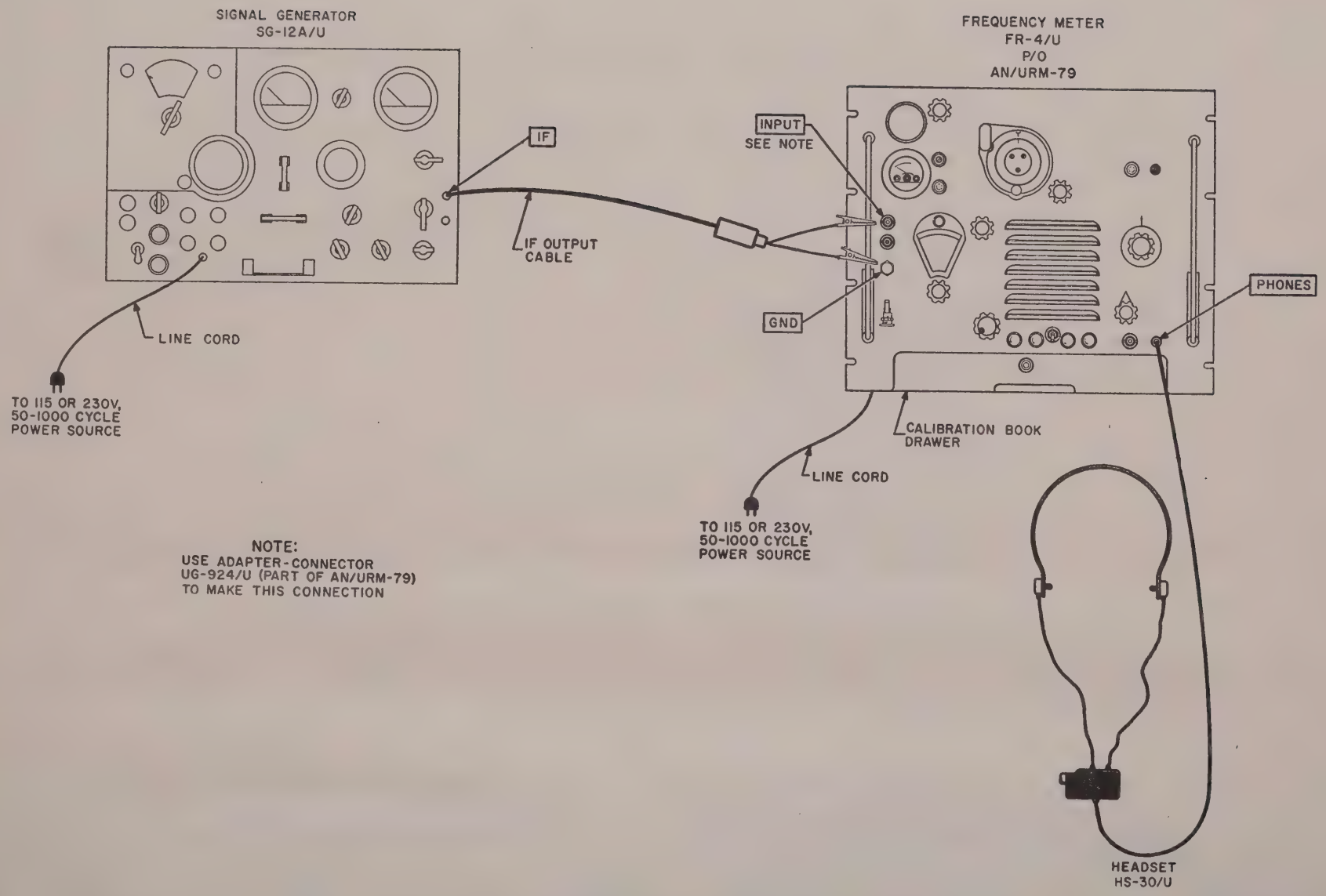


Figure 43.3. IF oscillator frequency calibration check

90.12. IF Oscillator Frequency Calibration Check

a. Test Equipment and Materials.

Frequency Meter FR–4/U (p/o AN/URM–79)

Headset HS–30/U

b. Test Connections and Conditions. Connect the equipment as shown in figure 43.8. After turning on the FR–4/U (p/o AN/URM–79), allow at least a 20-minute warmup time before proceeding with the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*FR–4/U* BAND SWITCH: Band 4. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	OPERATION: IF. IF FREQUENCY MC: 1.37. IF MICROVOLTS: 1K. POWER switch: ON.	*a.* Adjust the SG–12A/U IF LEVEL control for an indication of 10 on the IF MICROVOLTS, RF SET TO LINE meter. *b.* Using the operating procedure on page 23 of the FR–4/U (p/o AN/URM–79) calibration book, measure the frequency of the SG–12A/U output.	*a.* None. *b.* The output frequency of the SG–12A/U is within 1,369,931 – 1,370,069 cycles.
2	Same as step No. 1.	IF FREQUENCY MC: 1.40.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 1,399,931–1,400,070 cycles.
3	Same as step No. 1.	IF FREQUENCY MC: 1.43.	Repeat step No. 1*a* and *b*.	The frequency of the SG–12A/U is within 1,429,927–1,430-073 cycles.
4	*FR–4/U* BAND SWITCH: Band 5. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 4.27.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,269,786–4,270,214 cycles.
5	Same as step No. 4.	IF FREQUENCY MC: 4.30.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,299,785–4,300,215 cycles.
6	Same as step No. 4.	IF FREQUENCY MC: 4.33.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,329,783–4,330,217 cycles.
7	Same as step No. 4.	IF FREQUENCY MC: 4.45.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,449,777–4,450,223 cycles.
8	Same as step No. 4.	IF FREQUENCY MC: 5.00.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 4,999,750–5,000,250 cycles.
9	*FR–4/U* BAND SWITCH: Band 6. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 5.35.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within 5,349,-723 – 5,350,268 cycles.
10	*FR–4/U* BAND SWITCH: Band 7. FUNCTION SW: MEAS. INPUT ATTENUATOR: Fully clockwise. POWER switch: ON.	IF FREQUENCY MC: 15.	Repeat step No. 1*a* and *b*.	The output frequency of the SG–12A/U is within the 14,-999,250 – 15,000,750 cycles.

90.13. Performance Standards Summary

	Performance standard
a. RF output test.	0.05 milliwatts ± 25% (all bands).
b. RF oscillator frequency calibration check.	±0.03%.
c. Frequency deviation test (modulation).	
(1) Band A (25 mc).	
(*a*) 25-kc deviation range.	7.5 ± 3 kc.
(*b*) 50-kc deviation range.	40 ± 8 kc.
(*c*) 100-kc deviation range.	75 ± 15 kc.
(2) Bands B, C, D and E (100-kc deviation range only).	75 ± 15 kc.
d. Modulation distortion and internal Modulation frequency test.	
(1) Modulation distortion.	5% max.
(2) Internal modulation frequency.	1,000 cycles ±5%.
e. Noise test.	—50 db down.
f. If oscillator output and attenuator test.	
(1) Output (1-volt settings all frequencies).	1 volt ±25%.
(2) Attenuator.	20 ± 1 db change each step.
g. If oscillator frequency calibration check	—0.005% (each frequency).

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5–600	11–597
5–605	11–608
7	17
7–52	29–51
9–217	29–55
11–5	29–56
11–6	39–61
11–7	57
11–8	

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

U. S. Government Printing Office: 1961—591782

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APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3, SR 310–20–4, and SR 310–20–5. Check Department of the Army Supply Catalog SIG 1 for Signal Corps Supply Catalogs.

1. Army Regulations

AR 380–5_____ Military Security (Safeguarding Security information).
AR 750–5_____ Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Auxiliary Equipment and Test Equipment

TM 11–303____ Test Sets I–56–C, I–56–D, I–56–H, and I–56–J.
TM 11–307____ Signal Generators I–72–G, H, J, K and L.
TM 11–321____ Test Set I–56–E.
NAVSHIPS 91269. Electronic Multimeter ME–6A/U.
TM 11–1242___ Crystal Rectifier Test Set TS–268(*)/U.
TM 11–2019___ Test Set I–49.
TM 11–2039___ Audio Oscillators TS–379/U, TS–379A/U, and TS–379B/U.
TM 11–2526___ Oscilloscope BC–1060–A.
TM 11–2613___ Voltohmmeter I–166.
TM 11–2626___ Test Unit I–176, I–176–A, and I–176–B.
TM 11–2627___ Tube Tester I–177 and I–177–A.
TB 11–2627–3_ Tube Socket Adapter Kit MX–949/U.
TM 11–2649___ Audio Oscillator TS–421/U (Hewlett-Packard Model 205–AG).
TM 11–2684A__ Audio Oscillator TS–382A/U.
TM 11–2689A__ Oscilloscope I–245–A.
TM 11–4700___ Electrical Indicating and Measuring Instruments; Repair Instructions.
TM 11–5030___ Signal Generator TS–497A/URR.

3. Painting, Preserving, and Lubrication

TB SIG 13____ Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69____ Lubrication of Ground Signal Equipment.
TM 9–2851____ Painting Instructions for Field Use.

4. Camouflage, Decontamination, and Demolition

FM 5–20_____ Camouflage, Basic Principles.
FM 5–25_____ Explosives and Demolitions.
TM 3–220_____ Decontamination.

5. Other Publications

FM 24–18_____ Field Radio Techniques.
FM 72–20_____ Jungle Warfare.
SR 310–20–3___ Index of Training Publications.
SR 310–20–4___ Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
SR 310–20–5___ Index of Administrative Publications.
SR 700–45–5___ Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 725–405–5_ Preparation and Submission of Requisitions for Signal Corps Supplies.

SR 745–45–5/ AFR 71–4.	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army) and AF–MC–U2 (Air Force)).
TB SIG 4	Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 223	Field Expedients for Wire and Radio.
TM 11–310	Schematic Diagrams for Maintenance of Ground Radio Communication Sets.
TM 11–455	Radio Fundamentals.
TM 11–466	Radar Electronic Fundamentals.
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.

APPENDIX II
IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O & E, T/A, SIG 7 & 8, list of allowances of expendable material, or another authorized supply basis. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Signal Generator SG–12/U

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	GENERATOR SIGNAL AN/URM–48: 20 to 100 mc r-f range; 1.4 mc, 2.515 mc, 2.65 mc, 2.88 mc, 4.3 mc, 4.45 mc, 5 mc, 5.35 mc, and 15 mc fixed freq i-f range; r-f ranges; 5 bands; i-f range 9 fixed freq w/provisions for 2 additional fixed freq; 115 and 230 v a-c, 50 to 1000 cps, 1 ph.		3F3901.2–48
	CASE CY–1217/U: 21⅝ in. lg x 15⅝ in. d x 16 1⅞₂ in. h; A. R. F. Products, Inc. part/dwg #1D11952.	Carrying case for Signal Generator SG–12/U.	6F300–1217
	DUMMY LOAD ELECTRICAL DA–69/URM–48: 20 mc to 100 mc operating freq range.	Used to simulate whip antenna to receivers under test.	2Z3899–69
	SIGNAL GENERATOR SG–12/U: 20 mc to 102 mc range; 1.4 mc, 2.515 mc, 2.65 mc, 2.88 mc, 4.3 mc, 4.45 mc, 5.00 mc, 5.35 mc, and 15.0 mc fixed freq; 5 bands; 9 fixed frequencies ±½% accuracy on freq bands, fixed frequencies are xtal controlled; .05 μv to 10,000 μv ranges; 10 μv to 1 v by steps for the fixed freq output; ±2 db max variation throughout freq range; 10 ohms output impedance on ranges; 25 ohms output impedance on fixed freq; f-m, 1000 cyc int modulation, term. provided for ext modulation; ac, 115 v or 230 v, 50 to 1000 cyc, single ph; 21½ in. lg x 15½ in. wd x 16½ in. h o/a; A. R. F. Products, Inc.	Generates calibrated test frequencies.	3F3901.1–12
	ATTENUATOR fixed: resistive type; 50 ohms input impedance, 10 ohms output impedance; 20- to 100-mc freq response; ¾ in. sq x 3⅜₁₆ in. lg o/a excluding term.; A. R. F. Products, Inc. part/dwg #1B12532.	Fixed attenuator on r-f output cable.	2Z395.102
	ATTENUATOR variable: wave guide type, brass cavity, silver pl, 1⅞₂ in. dia; 20 mc to 100 mc freq response; 130 db max attenuation, ±5% tol continuously var; 6½ in. lg x 2¼ in. h x 2½ in. wd o/a excluding term.; A. R. F. Products, Inc. part/dwg #1C12171.	R-f box attenuator	2Z394.111

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	ATTENUATOR variable: resistive, type, unbalanced ladder, comp resistors; 50 ohms input impedance, 50 ohms output impedance; 0 to 15 mc freq response; 0 to 100 db range, ±2% tol, var in 6 steps; 3½ in. lg x 2½ in. h x 2½ in. wd o/a; incl switches S4 and S5, mp and fp; 20 db attenuation per step, ±1% tol per step; A. R. F. Products, Inc. part/dwg #1C12568.	I-f output calibrated attenuator	2Z394.112
C15	CAPACITOR fixed: ceramic dielectric; 1 μμf ±.25 μμf; 500 vdcw; JAN type CC21CK010C.	V3 modulator to CR1 mixer coupling capacitor.	3D9001–14
C66	CAPACITOR fixed: ceramic dielectric; 2.1 μμf ±.25 tol 500 vdcw JAN type CC20UJ2R1C.	Temperature compensating	3D9002E1
C18	CAPACITOR fixed: ceramic dielectric; 10 μμf ±.25 μμf; 500 vdcw; JAN type CC20CH100C.	V5 reactance modulator phase shift capacitor.	3D9010–163
C31	CAPACITOR fixed: electrolytic; .6 μf; 400 vdcw; JAN type CE63C060Q.	V7 and V8 screen grids bypass capacitor.	3DB6–47
C14	CAPACITOR fixed: ceramic dielectric; 10 μμf ±.5 μμf; 500 vdcw; JAN type CC21CK100D.	V4 harmonic amplifier output coupling capacitor.	3D9010–102
C47	CAPACITOR fixed: mica dielectric; 12 μμf ±5%; 500 vdcw; ½ in. lg x 9/32 in. wd x 1/64 in. thk, case dimen; Electro Motive type #CM15E120J.	Fifteen-mc i-f tank coil capacitor	3D9012–66
C23	CAPACITOR, fixed: ceramic dielectric; 10 μμf ±.25 μμf; 500 vdcw; −470 μμf per μf per deg C negative, +60 μμf tol; JAN type CC20TJ100C.	R-f oscillator V6, temperature compensating capacitor.	3D9010–216
C4	CAPACITOR, fixed: electrolytic; 25 μf; 25 vdcw; JAN type CE61C250F.	V1 cathode bypass capacitor	3DB25–130
C62	CAPACITOR, fixed: mica dielectric; 30 μμf, ±5%; 500 vdcw; ½ in. lg x 3/16 in. wd x 9/32 in. thk, case dimen; Electro Motive type #CM15E300J.	Fifteen-mc tank circuit capacitor	3D9030–80
C20	CAPACITOR, fixed: ceramic dielectric; 39 μμf, ±5%; 500 vdcw; JAN type CC20UJ390J.	Compensation for turret lead inductance on E band.	3D9039–49
C11	CAPACITOR, fixed: ceramic dielectric; 68 μμf, ±5%; 500 vdcw; JAN type CC26UJ680J.	CR1 mixer output filter capacitor	3D9068–14
C22	CAPACITOR, fixed: ceramic dielectric; 82 μμf, ±5%; 500 vdcw; JAN type CC26UJ820J.	V6 r-f oscillator grid coupling capacitor.	3D9082–21
C46, C61	CAPACITOR, fixed: mica dielectric; 100 μμf, ±5%; 500 vdcw; ½ in. lg x 9/32 in. wd x 1/64 in. thk, case dimen; Electro Motive type #CM15E101J.	C46: 5.35-mc oscillator tank coil capacitor. C61: 5.35-mc i-f amplifier plate tank circuit capacitor.	3D9100–285
C44, C45, C59, C60.	CAPACITOR, fixed: mica dielectric; 120 μμf, ±5%; 500 vdcw; ½ in. lg x 3/16 in. wd x 9/32 in. thk, case dimen; Electro Motive type #CM15E121J.	C44: 4.3-mc oscillator tank coil capacitor. C45: 5.0-mc oscillator tank capacitor. C59: 4.45-mc i-f amplifier tank capacitor. C60: 5.0-mc i-f amplifier tank capacitor.	3D9120–45

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C7, C39, C54	CAPACITOR, fixed: mica dielectric; 150 μμf, ±5%; 500 vdcw; ½ in. lg x 3/16 in. wd x 3/32 in. thk, case dimen; Electro Motive type #CM15E151J.	C7: V3 plate tank capacitor. C39: 4.3-mc oscillator plate tank capacitor. C54: 4.3-mc i-f amplifier plate tank capacitor.	3D9150–101
C40, C55	CAPACITOR, fixed: mica dielectric; 220 μμf, ±5%; 500 vdcw; ½ in. lg x 3/16 in. wd x 3/32 in. thk, case dimen; Electro Motive type #CM15E221J.	C40: 2.88-mc oscillator plate tank capacitor. C55: 2.88-mc i-f amplifier output tank capacitor.	3D9220–42
C41, C56	CAPACITOR, fixed: mica dielectric; 240 μμf, ±5%; 500 vdcw; ½ in. lg x 3/16 in. wd x 3/32 in. thk, case dimen; Electro Motive type #CM15E241J.	C41: 2.65-mc oscillator plate tank capacitor. C56: 2.65-mc i-f amplifier plate tank capacitor.	3D9240–31
C42, C57	CAPACITOR, fixed: mica dielectric; 270 μμf, ±5%; 500 vdcw; ½ in. lg x 3/16 in. wd x 3/32 in. thk, case dimen; Electro Motive type #CM15E271J.	C42: 2.515-mc oscillator plate tank capacitor. C57: 2.515-mc i-f amplifier plate tank capacitor.	3D9270–25
C43, C58	CAPACITOR, fixed: mica dielectric; 470 μμf, ±5%; 500 vdcw; 11/16 in. lg x 7/16 in. wd x 7/32 in. thk, case dimen; Electro Motive type #CM19E471J.	C43: 1.4-mc oscillator tank capacitor. C58: 1.4-mc i-f amplifier tank capacitor.	3D9470–50
C9, C10, C19, C48, C49.	CAPACITOR, fixed: ceramic dielectric; 470 μμf, ±20%; 500 vdcw; Centralab type #BC–20A.	C9: V3 calibrating oscillator plate to grid coupling capacitor. C10: V3 calibrating oscillator output coupling capacitor. C19: V5 reactance modulator tube plate decoupling capacitor. C48: V13 input coupling capacitor. C49: V14 input coupling capacitor.	3D9470–36
C16, C17	CAPACITOR, fixed: ceramic dielectric; 800 μμf, +100% −0% tol, 500 vdcw; ¼ in. dia x 3/32 in. thk, case dimen; Erie Resistance Corp., type #831.	C16: R-f bypass for screen grid of V4. C17: Cathode r-f bypass for V4.	3D9800–29
C27, C28	CAPACITOR, fixed: mica dielectric; 1000 μμf, ±2%; 500 vdcw; JAN type CM30D102G.	C27: V7 grid coupling capacitor. C28: V7 grid phase shift capacitor.	3K3010243
C5, C8, C12, C13, C26, C35, C38, C50 through C52, C63, C65.	CAPACITOR, fixed: ceramic dielectric; disk case; 5000 μμf, ±20%; 500 vdcw; 19/32 in. dia x 3/16 in. thk, case dimen; Centralab type #DA–048–001A.	C5: V2 plate r-f bypass capacitor. C8: L1 r-f grounding capacitor. C12: V4 cathode bias capacitor. C13: V4 screen grid bypass capacitor. C26: CR2 crystal monitor r-f filter bypass capacitor. C35: CR3 crystal monitor i-f filter bypass capacitor. C38: L17 through L25 tank coils r-f grounding capacitor. C50: V14 cathode bias capacitor. C51: V14 screen grid bypass capacitor. C52: V14 plate supply decoupling capacitor. C63: V3 cathode follower plate bypass capacitor. C65: V13 cathode follower plate bypass capacitor.	3DA5–244

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C1, C3, C32	CAPACITOR, fixed: paper dielectric; 10,000 μμf, +20% −10%; 600 vdcw; JAN type CP26A1EF103V.	C1: V1 input coupling capacitor C3: V1 plate to V2 grid coupling capacitor. C32: V8 output coupling capacitor.	3DA10–334
C53	CAPACITOR, fixed: paper dielectric; 50,000 μμf +10% −10%; 600 vdcw; JAN type CP28A1EF503K.	I-f amplifier tank circuit output coupling capacitor.	3DA50–248
C64	CAPACITOR, fixed: paper dielectric; 100,000 μμf, ±20%; 600 vdcw; JAN type CP26A1EF104M.	I-f box filament line decoupling capacitor.	3DA100–720
C29, C33	CAPACITOR, fixed: paper dielectric; 100,000 μμf, +20% −10%; 600 vdcw; JAN type CP61B1FF104V.	C29: V7 plate to V8 grid coupling capacitor. C33: V9 input coupling capacitor.	3DA100–718
C2A, C2B, C67	CAPACITOR, fixed: paper dielectric; 2 sect., ½ μf per sect., +20% −10%; 600 vdcw; JAN type CP61B6FF504V.	C2A: V1 screen grid bypass C2B: V2 screen grid bypass capacitor. C67: R-f box heater bypass and balance.	3DA500–751
C30, C34	CAPACITOR, fixed: paper dielectric; 1μf, +20% −10%; 600 vdcw; JAN type CP61B1EF105V.	C30: V8 to V7 coupling capacitor C34: V9 cathode follower output coupling capacitor.	3DB1–137
C36	CAPACITOR, fixed: paper dielectric; 4 μf, +20% −10%; 600 vdcw; JAN type CP70E1EF405V.	Power supply filter capacitor	3DB4–279
C6A, C6B, C6C	CAPACITOR, fixed: electrolytic; 3 sect., 10 μf per sect., 400 vdcw; JAN type CE53C100Q.	C6A: V1 and V2 plate decoupling C6B: V7 and V8 plate decoupling. C6C: V9 cathode follower plate signal grounding capacitor.	3DB10–272
C37A, C37B	CAPACITOR, fixed: electrolytic; 2 sect., 35 μf per sect., 400 vdcw; JAN type CE52C350Q.	Power supply filter capacitor	3DB35–8
C25	CAPACITOR, variable: air dielectric; plate meshing type; 5.3 μμf. max, 2.1 μμf min; scdr adj, 90° rotation; Johnson EF #5MB11.	R-f oscillator trimmer capacitor	3D9005VE3
C21	CAPACITOR, variable: air dielectric; plate meshing type; 8.7 μμf max, 1.7 μμf min; scdr adj, 180° rotation; Johnson EF #9M11.	R-f oscillator CORRECTOR capacitor.	3D9008VE7–1
C24A, C24B, C24C.	CAPACITOR, variable: air dielectric; plate meshing type; 3 sect.; 17.2 μμf max, 9.2 μμf min, 77.6 μμf max, 12.4 μμf min, 66.8 μμf max, 8.0 μμf min; 180° ccw rotation; RCC dwg #44C11505.	R-f oscillator main tuning capacitor.	3D9077VE6
	CAPACITOR, fixed: ceramic dielectric, feed thru; 20,000 μμf ±20%; 250 v a-c w Sprague type #1588.	Part of Z14 input filter	3DA20–275
	CHAIN, welded: sprocket gear drive; 18 in. lg o/a dimen; Boston Gear type #25.	Drives range switch	2Z2309–9
	CHAMBER, cable terminal: 2 pairs of term.; cast aluminum chamber w/ins panel; 4¾ in. lg x 1 9/16 in. wd x 1 9/16 in. h o/a; A. R. F. Products, Inc. part/dwg #1B12531.	I-f cable termination terminal chamber.	3Z990

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
L3 through L5, L35	CHOKE, RF: 14 μh; ⅜ in. lg x 5/32 in. dia o/a excluding term.; Jeffers Electronic Co. part #CF1 ⅜–50/38.	L3: V5 screen grid and plate circuit decoupling choke. L4: V5 control grid decoupling choke. L5: CR2 rectifier decoupling choke. L35: R-f box V3 and V4 plate supply choke.	3C323–192H
	CLAMP, electrical: ss, top hat type No. 2 Times Facsimile Corp.	Clamps V10, and RT-1 to chassis	2Z1619–79
	CLAMP, electrical: steel; tinned; U-shaped; JAN type CP06SA2.	Clamps capacitor to mounting panel.	2Z1239.165
	CLAMP, electrical: steel; tinned; JAN type CP06SA6.	Clamps capacitor to mounting panel.	2Z1239.168
	CLAMP, electrical: steel; tinned; JAN type CP07SB4.	Clamps capacitor to mounting panel.	2Z1239.155
	CLIP, electrical: phosphor bronze; nickel plate; 1⅛ in. lg x 13/32 in. wd x ¼ in. d o/a; A. R. F. Products, Inc. part/dwg #39A5634.	Holds crystal in socket	2Z2712.301
	CLIP, electrical: spring steel, gray chrome; 3 5/16 in. lg x 5/16 in. wd x ⅞ in. h o/a; A. R. F. Products, Inc. part/dwg #39A12112.	Holds r-f terminal box on panel	2Z2712.303
	CLIP: spring steel; gray chrome; 2⅜ in. lg x ½ in. wd x ⅞ in. h o/a; A. R. F. Products, Inc. part/dwg 39A12111.	Holds i-f terminal box on panel	2Z2712.302
	CLIP, electrical: alligator; 2 in. lg x ¼ in. wd x ⅜ in. h o/a; Mueller Elec type #60–HS.	Used for distribution of i-f output	3Z1087
	CLIP, retaining: Phosphor bronze; nickel plate; 1⅛ in. lg x 13/32 in. wd x ¼ in. d o/a; A. R. F. Products, Inc. part/dwg #39A5634.	Holds crystal in socket	2Z2712.301
	COIL ASSEMBLY, RF: contains 5 coils, 21 μh, 1.14 μh, .6 μh, .365 μh, .166 μh; 4⅞ in. lg x 3½ in. wd x 2¾ in. h o/a; A. R. F. Products, Inc. part/dwg #1C11974.	R-f box coil turret to change frequency bands.	3C4031–1
L14	COIL, RF: .166 μh measured at 25 mc; 1¼ in. lg x ½ in. wd x 11/16 in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12553.	E band r-f oscillator tank coil	3C1084Z87–13
L13	COIL, RF: .365 μh measured at 25 mc; 1¼ in. lg x ½ in. wd x 11/16 in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12551.	D band r-f oscillator tank coil	3C1084Z87–2
L12	COIL, RF: .6 μh measured at 25 mc; 1¼ in. lg x ½ in. wd x 11/16 in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12552.	C band r-f oscillator tank coil	3C1084Z87–3
L8	COIL, RF: .88 μh measured at 27 mc; 12 turns, #32 AWG; .406 in. lg x .275 in. dia, coil dimen; A. R. F. Products, Inc. part/dwg #1A12670.	V5 reactance modulator phase shift coil on turret, band B, wound on resistor R29.	3C1084Z87–18
L6	COIL, RF: 1.21 μh measured at 20 mc; 20 turns, #32 AWG; .406 in. lg x .275 in. dia, coil dimen; A. R. F. Products, Inc. part/dwg #1A12669.	V5 reactance modulator phase shift coil on turret, band A, wound on resistor R28.	3C1084Z87–17
L11	COIL, RF: 1.14 μh measured at 25 mc; 10 turns, #26 AWG; 1¼ in. lg x ½ in. wd x 11/16 in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12554.	B band r-f oscillator tank coil	3C1084Z87–14

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
L25, L34	COIL, RF: 1.55 μh measured at 17.3 mc w/o core, .075 ohm d-c resistance; 20 turns, #27 AWG; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12232.	L25: I-f oscillator 15.0-mc tank coil. L34: I-f amplifier 15.0-mc tank coil.	3C1084Z87–1
L10	COIL, RF: 2.1 μh measured at 7.9 mc; 14 turns, #26 wire AWG; 1¼ in. lg x ½ in. wd x 1 1/16 in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12555.	A band r-f oscillator tank coil	3C1084Z87–15
L24, L33	COIL, RF: 4.2 μh measured at 6.75 mc w/o core, .68 ohm d-c resistance; 22 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12231.	L24: I-f oscillator 5.35-mc tank coil. L33: I-f amplifier 5.35-mc tank coil.	3C1084Z87–7
L23, L32	COIL, RF: 4.9 μh measured at 5.6 mc w/o core, .75 ohm d-c resistance; 24 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12230.	L23: I-f oscillator 5.00-mc tank coil. L32: I-f amplifier 5.00-mc tank coil.	3C1084Z87–6
L22, L31	COIL, RF: 5.7 μh measured at 5.68 mc w/o core, .8 ohm d-c resistance; 26 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12229.	L22; I-f oscillator 4.45-mc tank coil. L31: I-f amplifier 4.45-mc tank coil.	3C1084Z87–5
L17, L26	COIL, RF: 6.2 μh measured at 4.6 mc w/o core, .84 ohm d-c resistance; 27 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12228.	L17: I-f oscillator 4.30-mc tank coil. L26: I-f amplifier 4.30-mc tank coil.	3C1084Z87–4
L20, L29	COIL, RF: 10.1 μh measured at 2.97 mc w/o core, 1.1 ohms d-c resistance; 35 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12225.	L20: I-f oscillator 2.515-mc tank coil. L29: I-f amplifier 2.515-mc output tank coil.	3C1084Z87–10
L18, L27	COIL, RF: 8.6 μh measured at 3.45 mc w/o core, 1.05 ohms d-c resistance; 32 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R F. Products, Inc. part/dwg #1A12227.	L18: I-f oscillator 2.88-mc tank coil. L27: I-f amplifier 2.88-mc tank coil.	3C1084Z87–9
L19, L28	COIL, RF: 10.3 μh measured at 3.2 mc w/o core, 1.1 ohms d-c resistance; 35 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12226.	L19: I-f oscillator 2.65-mc tank coil. L28: I-f amplifier 2.65-mc tank coil.	3C1084Z87–8
L21, L30	COIL, RF: 20.5 μh measured at 1.71 mc w/o core, 1.6 ohms d-c resistance; 50 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12224.	L21: I-f oscillator 1.4-mc tank coil. L30: I-f amplifier 1.4-mc tank coil	3C1084Z87–11
L1	COIL, RF: 26.5 μh measured at 2 mc w/o core, 1.9 ohms d-c resistance; 57 turns, #7–44 SSE litz wire; 1½ in. lg x 7/32 in. wd x ½ in. h o/a; adj iron core, scdr adj; A. R. F. Products, Inc. part/dwg #1A12223.	V3 calibrating oscillator tank coil	3C1084Z87–12
Z14	COIL, power filter: 20 μh; 0.162 ohms d-c resistance; A. R. F. Products, Inc. part/dwg #1A11732.	Part of Z14 power input filter	3C319K–4

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
L2, L7, L36	CHOKE, RF: .9 μh; 1½ in. lg x ½ in. dia o/a; A. R. F. Products, Inc. part/dwg #1A12501.	L2: R-f box V3 and V4 filament lead choke. L7 and L36: R-f box V5 and V6 filament lead choke.	3C1084Z87–20
	CONNECTOR, PLUG U–120/U: 2 male flat cont; 10 amp 250 v.		2Z7250–120
P1, P2, P4, P5, P6.	CONNECTOR, plug: Radio Frequency Plug UG–88/U; 1, male, round; straight type; Amphenol #31–002.	P1: R-f box output plug P2: Panel cable r-f plug. P4: I-f attenuator plug. P5: I-f oscillator plug. P6: I-f attenuator panel output plug.	2Z7390–88
P8	CONNECTOR, plug: 15, male, round pol; straight type; Amphenol #26–152.	Front panel and chassis interconnect plug.	2Z3035–35
J1, J6	CONNECTOR, receptacle: Jack UG–291/U; 1, female, round; straight type; Industrial Products Co. type #5000.	J1: R-f box output receptacle. J6: I-f attenuator panel output plug.	2Z3062–167
J2, J4	CONNECTOR, receptacle: Receptacle UG–290/U; 1, female, round; straight type; Industrial Products Co. type #4500.	J2: R-f cable termination connector receptacle. J4: I-f attenuator assembly connector receptacle.	2Z7390–290
J5	CONNECTOR, receptacle: Receptacle Connector UG–535/U; 1, female, rd; 90° angle; ¾ in. lg x ¾ in. wd x ⅝ in. h o/a; Industrial Products Co. type #5675.	I-f oscillator connector	2Z7390–535
J3	CONNECTOR, receptacle: 1, male, round; straight type; Industrial Products Co. type #3150.	R-f cable termination box plug connector.	2Z3021–261
	CONNECTOR, receptacle: single cont; straight 13/16 in. lg; cylindrical, steel; Industrial Products, Inc. type #1025.	Used as an i-f cable termination receptacle connector.	2Z3062–283
J7, J9	CONNECTOR, receptacle: 15 female cont round; pol; straight; American Phenolic Corp. type #26–153.	J7: R-f box receptacle J9: I-f box receptacle.	2Z3076–35
	CONTACT, electrical: p/o crystal turret; phosphor-bronze cont; silver pl; 1½ in. lg x 1 1/16 in. wd x 1¼ in. ho/a; A. R. F. Products, Inc. part/dwg #1B12542.	Makes contact to crystals in turret.	2Z3194–73
	CONTACT, electrical: Mycalex 410 pl body, silver clad on phosphor chrome cont springs; 3 15/32 in. lg x 2 13/16 in. wd x 5/16 in. thk o/a; A. R. F. Products, Inc. part/dwg #1B12575.	Makes electrical connection between coil turret and other part of the circuit on r-f chassis.	2Z3194–74
	CONTACT, electrical: 1½ in. lg x ⅝ in. wd x .015 in. thk; A. R. F. Products, Inc. part/dwg #39A11649.	Contact clip on i-f step attenuator	2Z3194–77
	CONTACT, electrical: ⅝ in. lg x 5/32 in. wd x ½ in. h; Standard Coil Prod. Co type #31B001.	Makes contact with r-f oscillator coils.	2Z3194–78
	COUPLING, shaft, rigid: sleeve; one end permanently attached to one shaft and engaging the other by means of splined ID; ⅜ in. dia. x ⅝ in. lg; A. R. F. Products, Inc. part/dwg #31A12625.	Couples CORRECTOR panel shaft to r-f box.	2Z3273–281
	COUPLING, shaft, rigid: sleeve; one end permanently attached to one shaft, engaging the other by means of splined ID; 7/16 in. dia. x 13/16 in. lg; A. R. F. Products, Inc. part/dwg #31A12687.	Couples RF SET TO LINE panel shaft to r-f attenuator shaft.	2Z3273–282

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
J7, J9	COUPLING, flexible: ⅝ in. lg x 2 in. dia o/a; coupling to allow for linear misalinement of shafts; A. R. F. Products, Inc. part/dwg #132A12703.	Conveys a drive from range switch on front panel to coil turret r-f box.	2Z3295–187
	COUPLING, flexible: monel spring wire; ⅝ in. lg x ¾ in. dia o/a; coupling to allow for linear misalinement of shafts; A. R. F. Products, Inc. part/ dwg #132A12704.	Conveys a drive from R-F TUNING knob on front panel to gang condenser in r-f box.	2Z3295–186
Y4	CRYSTAL UNIT, quartz: 2880 kc nom freq; Crystal Holder HC–6/U; 2 pins spaced .482 in. c to c, .050 in. dia x .243 in. lg; marked 2880 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN CR–19/U; Bliley Elec type #CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–2880
Y5	CRYSTAL UNIT, quartz: 4300 kc nom freq; Crystal Holder HC–6/U; 2 pins spaced .482 in. c to c, solid type, .050 in. dia x .243 in. lg; marked 4300 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN CR–19/U; Bliley Elec type #CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–4300
Y6	CRYSTAL UNIT, quartz: 4450 kc nom freq; Crystal Holder type #HC–6/U; 2 pins spaced .482 in. c to c, solid type, .050 in. dia x .243 in. lg; marked 4450 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN Crystal Unit CR–19/U; Bliley Elec type CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–4450
Y7	CRYSTAL UNIT, quartz: 5000 kc nom freq; crystal holder; 2 pins spaced .482 in. c to c, solid type .050 in. dia x .243 in. lg; marked 5000 kc; ±.005% tol of nom freq over temp range of −55° to +90° C, AN Crystal Unit CR–19/U; Bliley Elec type #CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–5000
Y8	CRYSTAL UNIT, quartz: 5350 kc nom freq; AN Crystal Holder HC–6/U; 2 pins spaced .482 in. c to c, solid type, .050 in. dia x .243 in. lg; marked 5350 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN CR–19/U; Bliley Elec type #CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–5350
Y9	CRYSTAL UNIT, quartz: 15,000 kc nom freq; AN Crystal Holder HC–6/U; 2 pins spaced .482 in. c to c, solid type, .050 in. dia x .243 in. lg; marked 15,000 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN Crystal Unit CR–19/U; Bliley Elec type #CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–15000
Y1	CRYSTAL UNIT, quartz: 1400 kc nom freq; AN Crystal Holder HC–6/U; 2 pins spaced .482 in. c to c, solid type, .050 in. dia x .243 in. lg; .720 in. wd x .758 in. h x .345 in. lg o/a marked 1400 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN CR–19/U; Bliley Elec type #CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–1400

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
Y10	CRYSTAL UNIT, quartz: 2000 kc nom freq; AN Crystal Holder HC–6/U; pin data 2 pins spaced .482 in. c to c, solid type, .050 in. dia x .243 in. lg; .720 in. wd x .758 in. h x .345 in. lg; marked 2000 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN CR–19/U; Bliley Elec type #CR–19/U.	Calibrating oscillator frequency stabilizing element.	2X237–2000
Y2	CRYSTAL UNIT, quartz: 2515 kc nom freq; AN Crystal Holder HC–6/U; 2 pins spaced .482 in. c to c, solid type, .050 in. dia x .243 in. lg; .720 in. wd x .758 in. h x .345 in. lg; marked 2515 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN Crystal Unit CR–19/U; Bliley Elec type #CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–2515
Y3	CRYSTAL UNIT, quartz: 2650 kc nom freq; AN Crystal Holder HC–6/U; 2 pins spaced .482 in. c to c, solid type, .050 in. dia x .243 in. lg; .720 in. wd x .758 in. h x .345 in. lg; marked 2650 kc; ±.005% tol of nom freq over temp range of −55° to +90° C; AN Crystal Unit CR–19/U; Bliley Elec type #CR–19/U.	I-f oscillator frequency stabilizing element.	2X237–2650
CR1, CR3, CR4, CR5	CRYSTAL UNIT, 1 rectifying: germanium type; JAN type N69.	CR1: R-f output, harmonic amplifier, output mixing crystal. CR3: I-f monitor output level rectifier. CR4: Deviation level rectifying bridge rectifier. CR5: Deviation level rectifying bridge rectifier.	2J1N69
CR2	CRYSTAL UNIT, rectifying: silicon type; JAN type 1N21B.	R-f output level monitor rectifier crystal.	2J1N21B
(2 units)	CURSOR, INDICATOR: plexiglas; ⅞ in. h x ¾ in. wd x 1/16 in. thk o/a; A. R. F. Products, Inc. part/dwg #110A11832.	(1) Hairline to show reading of r-f output voltage dial. (2) Hairline for vernier knob to show reading of frequency dial.	2Z3599–3
	CURSOR, INDICATOR: brass; baked chinese red enamel; 6¼ in. lg x 2 13/32 in. wd x 13/32 in. h o/a; A. R. F. Products, Inc. part/dwg #1B12184.	Hairline to show reading of frequency on main dial.	2Z3599–4
	DRIVE, TUNING: steel; nickel pl; 1¾ in. lg x 2⅝ in. dia; National Co. Inc. type #AVD.	Vernier drive for RF ATTENUATOR MICROVOLTS dial.	2Z3876.152
	DRIVE, TUNING: brass, music wire; 2⅛ in. dia x ½ in. h o/a; A. R. F. Products, Inc. part/dwg #1A12032.	Drive r-f oscillator gang condenser.	2Z3876.153
V1, V2, V4, V5, V7, V8.	TUBE, electron: type 6AH6	V1: Calibrating audio frequency amplifier tube. V2: Calibrating audio frequency output tube. V4: Calibrating signal harmonic amplifier tube. V5: Reactance tube modulator. V7: 1000 cps audio oscillator. V8: 1000 cps audio oscillator.	2J6AH6
V3	TUBE, electron: type 12AU7	Crystal calibrating oscillator	2J12AU7

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
V6	TUBE, electron: type 6J6	R-f oscillator	2J6J6
V9, V12, V13	TUBE, electron: type 6C4	V9: A-f output tube V12: I-f oscillator tube. V13: I-f oscillator tube.	2J6C4W
V10	TUBE, electron: type 5Y3GT	Full-wave high-vacuum rectifier	2J5Y3GT
V11	TUBE, electron: type OA2	Voltage-regulator tube	2J0A2
V14	TUBE, electron: type 6AK6	I-f amplifier output tube	2J6AK6
Z1, Z8	FILTER, low pass: 1½ in. lg x ¾ in. dia o/a; A. R. F. Products, Inc. part/dwg #1A1250	Z1: CR1 mixer output r-f filter Z8: CR3 i-f monitor rectifier output filter.	3Z1892–61
Z2, Z9, Z16	FILTER, low pass: 1½ in. lg x ¾ in. dia o/a; A. R. F. Products, Inc. part/dwg #1A12565	Z2: R-f box V3 and V4 heater line filter. Z9 and Z16: R-f box V5 and V6 heater line filter.	3Z1892–61.1
Z3, Z4, Z5, Z6	FILTER, low pass: 1½ in. lg x ¾ in. dia o/a; A. R. F. Products, Inc. part/dwg #1A12509	Z3: R-f box V3 and V4 plate-supply filter. Z4: R-f box V5 and V6 plate-supply filter. Z5: R-f box audio input to modulator r-f filter. Z6: CR2 r-f monitor output filter from r-f box.	3Z1892–61.2
Z7	FILTER, low pass: 1½ in. lg x ¾ in. dia o/a; A. R. F. Products, Inc. part/dwg #1A12507	External modulation input terminals filter.	3Z1892–61.3
Z14	FILTER, low pass: 5¼ in. lg x 3¼ in. wd x 2 in. h o/a; A. R. F. Products, Inc. part/dwg #1B11741.	Power line input filter	3Z1892–61.4
Z10, Z11, Z13	FILTER, low pass: 2 in. lg x 15/16 in. dia o/a; A. R. F. Products, Inc. part/dwg #1A12511.	Z10: I-f box plate-supply filter Z11: I-f box V14 screen-grid supply filter. Z13: I-f box V14 plate-supply filter.	3Z1892–61.5
Z12, Z15	FILTER, low pass: 1¾ in. lg x 15/16 in. dia o/a; A. R. F. Products, Inc. part/dwg #1A12514.	I-f box filament supply filter	3Z1892–61.6
F1, F2	FUSE, cartridge: 1 amp, 250 v; time delay; ¼ in. lg x ¼ in. dia; Littelfuse Part #313001	F1: Power-input line protection F2: Power-input line protection.	3Z2601.16
(4 units)	FUSEHOLDER: 125 v, 15 amp; cartridge type.	(1) Fuseholder for F1 (2) Fuseholder for F2. (3) Fuseholder for spare F1. (4) Fuseholder for spare F2.	3Z3285–6.7
	GASKET: 6 ft lg x 1/16 in. wd x 3/16 in. h; A. R. F. Products, Inc. part/dwg #96A12113.	To prevent stray r-f leakage	2Z4868.1273
P7, P9	INSERT, electrical connector: 15 male cont round; straight type; 1½ in. lg x ¾ in. wd x 13/16 in. h o/a; American Phenolic Corp. type #26–151.	P7: R-f box plug P9: I-f box plug.	2Z3035–31
J8	INSERT, electrical connector: 15 female cont, round; straight type; 1½ in. lg x ¾ in. wd x .415 in. h; ¾ in. wd x 1¾ in. h; Amphenol type #26–150.	Front panel and chassis interconnect receptacle.	2Z3076–31
	INSULATOR, disk: phenolic; round, flat w/f1; Eby type #6146.	Terminal insulator	3G280–48
	INSULATOR, feedthru: phenolic; thd insert shape; U. S. Engineering type #1433.	Voltage test terminal for cathode of modulator tube V5.	3G290–41
	KNOB: round; aluminum; designed to accom shaft, ¼ in. dia; marked in 100 scale divisions; A. R. F. Products, Inc. part/dwg #1B12557.	Drives main dial	2Z5822–688

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
J8	KNOB: round, aluminum; designed to accom shaft, 3/16 in. dia, A. R. F. Products, Inc. part/dwg #131A11924.	Turns r-f attenuator	2Z5822–687
	KNOB: round; zinc-alloy; designed to accom shaft, ¼ in. dia; A. R. F. Products, Inc. part/dwg #131B11811.	Turns BAND SWITCH	2Z5822–686
(6 units)	KNOB: round, zinc-alloy; designed to accom shaft, ¼ in. dia; phosphorescent line marking; A. R. F. Products, Inc. part/dwg #131B11708.	(1) RF SET TO LINE knob (2) Drives CORRECTOR. (3) Turns DEVIATION RANGE switch. (4) Turns OPERATION switch. (5) Turns DEVIATION LEVEL potentiometer. (6) Turns i-f level potentiometer.	2Z5822–685
(2 units)	KNOB: round; zinc-alloy; designed to accom shaft, ¼ in. dia; phosphorescent line marking; A. R. F. Products, Inc. part/dwg #131B11707.	(1) Turns i-f attenuator switch (2) Turns crystal turret.	2Z5822–684
I 3	LAMP, incandescent: 120 v; 3 w; clear; 1¾ in. max o/a height; Matchless Electric Co. type #386.	1,000-cycle, oscillator stabilizing resistance.	6Z6820–3.1
I 6	LAMP, glow: 105–120 v, 1/25 w; miniature bayonet base, clear; GE type #NE51.	Indicates when power in heater circuit is on.	2Z5888–5
I 7	LAMP LM–52: 6.3 v; .15 amp; clear; GE type #47.	POWER ON indication	2Z5952
I 1, I 2	LAMP, incandescent: 6.3 v; .2 amp; clear; GE type #328.	Illuminates frequency	2Z5877–12
XI 3	LAMPHOLDER: accom double cont bayonet candelabra base lamp; ⅞ in. lg, ¾ in. dia; Dialco type #65–10.	Socket for lamp I 3	2Z8672.79
XI 6	LIGHT, indicator: accom T–3–14 lamp, miniature bayonet base; 125 v; Dialco type #95408937.	HEATER ON indicator socket for I 6.	2Z5991–163
XI 7	LIGHT, indicator: accom T–3–14 lamp, miniature bayonet base, 125 v; Dialco type #95410952.	Socket for I 7	2Z5991–264
XI 1, XI 2	LIGHT, panel: 6 v; type T–1–3/4; Grimes Mfg type #A–5295–6.	XI 1: Dial socket for I 1 XI 2: Dial socket for I 2.	2Z5991–265
LS1	LOUDSPEAKER, dynamic: 12 ohms voice coil; 1⅝ in. dia; output transf not included; 1 31/32 in. dia, ⅞ in. d; Permoflux type #WE–2010X0.	Converts calibration beat signals to audible sound.	6C43–184
M2	METER, modulation: panel mtd; dc; marked "KILOCYCLES DEVIATION" 0 to 25; 0 to 50; 0 to 100 clockwise; 2.675 in. body dia, 1.063 in. body d from mtg surface, excluding term., ±5% accuracy at full-scale reading; 10,000 ohms per v, 100 ua required for full-scale deflection; Marion Elec Instr, made to A. R. F. dwg #150B11626.	Indicates the amount of deviation of the r-f output signal.	3F3316–1
	OSCILLATOR, subassembly: c/o one 6J6 tube, one 12AU7 tube, two 6AH6 tubes, one coil turret, one attenuator assem, one 2-mc xtal, associated parts and wiring; 11 in. lg x 6½ in. wd x 5¾ in. h; A. R. F. Products Inc. part/dwg #E11594.	Provides calibrated r-f output	2C2798–23

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
M2	OSCILLATOR, subassembly: principal parts c/o two 6C4 tubes, one 6AK6 tube, nine crystals, quartz appropriate frequency, associated switches and tuning coils, o/a housing and cover; 6 in. lg x 6 in. wd x 7¼ in. h; A. R. F. Products, Inc. part/dwg #1D11595.	I-f oscillator assembly	2C2798–22
E1, E2, E4, E5	POST, binding: ⅞ in. o/a h, above mtg surface, ½ in. OD; Eby type #7699.	E1: EXT MOD binding post (red). E2: EXT MOD binding post (black). E4: R-f output terminal (ground). E5: R-f output terminal (hot).	3Z737–13.3
L15, L16	REACTOR: 4.0 hy, .1 ma; 250 ohms max d-c resistance, 1000 v rms test voltage; Chi Trans #F046.	Power supply filter chokes	3C547–46
R36, R106	RESISTOR, fixed: comp; 20 ohms total resistance, ±1% tol; A. R. F. Products, Inc. part/dwg 191X12698.	Terminating resistor for r-f output transmission line.	3Z6002–86
R10	RESISTOR, fixed: comp; 15 ohms resistance, ±10% tol; ½ w; JAN type RC20BF150K.	T1 loading resistor	3RC20BF150K
R32	RESISTOR, fixed: comp; 27 ohms ±5% tol; ½ w, JAN type RC20BF270J.	Phase-shift resistor for reactance modulator tube V5 on band E.	3RC20BF270J
R30, R31	RESISTOR, fixed: comp; 33 ohms ±5% tol; ½ w; JAN type RC20BF330J.	R30: V5 phase shift resistor on band C. R31: V5 phase shift resistor on band D.	3RC20BF330J
R35	RESISTOR, fixed: comp; 40 ohms ±1% tol; ½ w; Continent Carbon, Inc. type #NF 1/2.	Terminating resistor for r-f output transmission line.	3Z6004–58
R75	RESISTOR, fixed: comp, 43 ohms ±1% tol; ½ w; 15/32 in. lg x .155 in. dia; Continent Carbon, Inc. type #NF 1/2.	I-f attenuator component resistor	3Z6004C3–10
R104	RESISTOR, fixed: comp; 47 ohms ±10% tol; ½ w; JAN type RC20BF470K.	V6 place circuit parasitic suppressor.	3RC20BF470K
R76, R84	RESISTOR, fixed: comp; 50 ohms ±1% tol; ½ w; Continent Carbon, Inc. type #NF 1/2.	R76: I-f attenuator component resistor. R84: I-f cable termination resistor.	3Z6005–17
R73, R74, R79, R81, R83.	RESISTOR, fixed: comp; 56 ohms ±1% tol; ½ w; Continent Carbon, Inc. type #NF 1/2.	I-f output attenuator resistors	3Z6005F6–13
R109	RESISTOR, fixed; comp; 68 ohms ±5% tol; ½ w; JAN type RC20BF680J.	Resistor used for dummy antenna	3RC20BF680J
R105	RESISTOR, fixed: comp; 68 ohms ±10% tol; ½ w; JAN type RC20BF680K.	V14 cathode resistor to reduce Miller effect in grid circuit.	3RC20BF680K
R103	RESISTOR, fixed: comp; 110 ohms ±1% tol; ½ w; Continent Carbon, Inc. type #NF 1/2.	I-f attenuator voltage-dropping resistor.	3Z6011–20
R26	RESISTOR, fixed: comp; 100 ohms ±10% tol; ½ w; JAN type RC20BF101K.	Cathode-biasing resistor for reactance modulator tube V5.	3RC20BF101K
R45, R51, R97	RESISTOR, fixed: comp; 150 ohms ±10% tol; ½ w; JAN type RC20BF151K.	R45: Cathode-biasing resistor for 1,000 cps oscillator tube V8. R51: Cathode-biasing resistor for modulator a-f output tube V9. R97: Cathode-biasing resistor for i-f amplifier tube V14.	3RC20BF151K
R7, R19	RESISTOR, fixed: comp; 220 ohms ±10% tol; ½ w; JAN type RC20BF221K.	R7: Cathode-biasing resistor for calibrated a-f output tube V2. R19: Cathode-biasing resistor for harmonic amplifier tube V4.	3RC20BF221K
R12,* R16*	RESISTOR, fixed: comp; 270 ohms ±10% tol; ½ w; JAN type RC20BF271K.	R12, R16: Cathode-biasing resistors for calibrated oscillator tube V3.	3RC20BF271K

* For equipments having serial number 20 or under.

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R12, R16, R63	RESISTOR, fixed: comp 820 ohms ±10%; ½ w; JAN type RC20BF821K.	R12, R16, R63: Cathode-biasing resistors for calibrated oscillator tube V3.	3RC20BF821K
R93, R94	RESISTOR, fixed: comp; 270 ohms ±10%; tol; ½ w; JAN type RC20BF271K.	R93: Cathode-biasing resistor for i-f oscillator tube V12. R94: Cathode-coupling resistor for i-f ocsillator tube V13.	3RC20BF271K
R21, R102	RESISTOR, fixed: WW; 400 ohms ±5%; tol; 4.5 w; JAN type RW30J401.	R21: Plate load resistor for harmonic amplifier V4. R102: Plate voltage-dropping resistor for r-f oscillator V6.	3RW21944
R72, R77, R78, R80, R82.	RESISTOR, fixed: comp; 450 ohms ±1% tol; ½ w; Continent Carbon, Inc. type #NF ½.	R72: I-f output attenuator resistor. R77: Ladder attenuator resistor. R78, R80, R82: Ladder i-f attenuator resistor.	3Z6045–42
R27, R34	RESISTOR, fixed: comp; 470 ohms ±10%; ½ w; JAN type RC20BF471K.	R27: V5 grid r-f decoupling resistor. R34: Output level monitor resistor.	3RC20BF471K
R37	RESISTOR, fixed: comp; 600 ohms ±1%; ½ w; data regarding a *typical mfr* Concarbon type #NF ½.	External modulation input resistor.	3Z6060–115
R11, R22, R92, R98, R99, R101, R40.	RESISTOR, fixed: comp; 1000 ohms ±10%; ½ w; JAN type RC20BF102K.	R11: Plate decoupling resistor for calibrating oscillator V3. R22: Screen grid dropping resistor for modulator V5. R92: Plate decoupling resistor for i-f oscillator V12. R98: Screen grid dropping resistor for i-f amplifier V14. R99: Plate decoupling resistor for i-f amplifier V14. R101: Plate decoupling resistor for i-f oscillator V13. R40: Cathode-biasing resistor V7.	3RC20BF102K
R2	RESISTOR, fixed: comp; 1500 ohms ±10%; ½ w; JAN type RC20BF152K.	Cathode-biasing resistor for calibrated a-f amplifier V1.	3RC20BF152K
R85, R86, R89	RESISTOR, fixed: WW; 1600 ohms ±5%; 15 w; JAN type RW20G162.	R85, R86: Heater resistors R89: Power supply B+ filter resistor.	3RW25510
R42	RESISTOR, fixed: comp; 2200 ohms ±10%; ½ w; JAN type RC20BF222K.	Negative feedback resistor for 1,000-cps oscillator.	3RC20BF222K
R64, R65, R67, R68.	RESISTOR, fixed: comp; 3000 ohms ±1%; ½ w; Concarbon type #NF 1/2.	Deviation range meter attenuating resistors.	3Z6300–232
R87	RESISTOR, fixed: WW; 3100 ohms ±5%; 22 w; JAN type RW21G312.	Power supply bleeder resistor	3RW27354
R56	RESISTOR, fixed: comp; 3300 ohms ±10%; ½ w; JAN type RC20BF332K.	Deviation meter circuit limiting resistor.	3RC20BF332K
R24, R25	RESISTOR, fixed: comp; 3300 ohms ±10%; 2 w; JAN type RC42BE332K.	Cathode-biasing bleeder limiting resistors for modulator tube V5.	3RC42BE332K
R46 through R48.	RESISTOR, fixed: comp; 4700 ohms ±10%; ½ w; JAN type RC20BF472K.	R46: Screen grid dropping resistor for 1,000-cps oscillators V7 and V8. R47: Plate decoupling resistor for 1,000-cps oscillator V8. R48: Plate circuit decoupling resistor for 1,000-cps oscillators V7 and V8.	3RC20BF472K

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R6, R52, R100	RESISTOR, fixed: comp; 4700 ohms ±10%; 2 w; JAN type RC41BE472K.	R6: Plate decoupling resistor for calibrated a-f output and amplifier tubes V1 and V2. R52: Cathode-biasing resistor for modulator tube V9. R100: Plate decoupling resistor for modulator tube V9.	3RC42BE472K
R66	RESISTOR, fixed: comp; 6000 ohms ±1%; ½ w; Concarbon type #NF 1/2.	Deviation range meter attenuating resistor.	3Z6560–87
R9, R13, R41, R55.	RESISTOR, fixed: comp; 10,000 ohms ±10%; ½ w; JAN type RC20BF103K.	R9: Plate dropping resistor, calibrated a-f output V2. R13: CR1 mixer filter coupling resistor. R41: Plate load resistor for 1,000-cps oscillator V7. R55: Current limiting resistor for meter M2.	3RC20BF103K
R53, R54	RESISTOR, fixed: comp; 22,000 ohms ±10%; ½ w; JAN type RC20BF223K.	Rectifier bridge resistors for meter M2.	3RC20BF223K
R33	RESISTOR, fixed: comp; 33,000 ohms ±10%; ½ w; JAN type RC20BF333K.	Grid leak resistor for r-f oscillator V6.	3RC20BF333K
R8, R15, R17, R18, R20, R95.	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; JAN type RC20BF473K.	R8: Screen grid dropping resistor for calibrated a-f amplifier V2. R15: CR1 mixer filter coupling resistor. R17: Grid leak resistor for calibrating oscillator V3. R18: Grid leak resistor for harmonic amplifier V4. R20: Screen grid dropping resistor for harmonic amplifier V4. R95: Grid leak resistor for i-f oscillator V13.	3RC20BF473K
R71, R96	RESISTOR, fixed: comp; 68,000 ohms ±10%; ½ w; JAN type RC30BF683K.	R71: CR3 i-f monitor rectifier filter coupling resistor. R96: Grid leak resistor for V14.	3RC20BF683K
R88	RESISTOR, fixed: comp; 68,000 ohms ±10%; 2 w; JAN type RC42BE683K.	Power supply bleeder resistor	3RC42BE683K
R44, R108	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K.	R44: Grid leak resistor for 1,000-cps oscillator V8. R108: V5 cathode balance current limiting.	3RC20BF104K
R38, R39	RESISTOR, fixed: comp; 158,000 ohms ±1%; ½ w; Concarbon type #NF ½.	R38: V7 feedback resistor R39: V7 grid phase shift resistor.	3H6715H8–2
R4	RESISTOR, fixed: comp; 150,000 ohms ±10%; ½ w; JAN type RC20BF154K.	Plate load resistor for calibrated a-f amplifier V1.	3RC20BF154K
R1, R3, R5, R50.	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; JAN type RC20BF474K.	R1: Grid leak resistor for calibrated a-f oscillator V1. R3: Screen grid dropping resistor for calibrated a-f oscillator V1. R5: Grid leak resistor for calibrating amplifier V2. R50: Grid leak resistor for modulated a-f output V9.	3RC20BF474K
R14	RESISTOR, fixed: comp; 680,000 ohms ±10%; ½ w; JAN type RC20BF684K.	Mixer CR1 filtering divider resistor	3RC20BF684K
R90	RESISTOR, variable: WW; 1000 ohms total ±10%; 3 w; CTS type #25 basic.	Voltage regulator stabilizing resistor.	3Z7310–118

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R43, R107	RESISTOR, variable: 5000 ohms ±10%; ½ w; CTS type #35 basic.	R43: Feedback control on 1,000 CPS oscillator tubes (V8 and V9). R107: Hum balance control for V5.	3Z7350–139
R58, R59, R69	RESISTOR, variable: 10,000 ohms ±10%; ½ w; CTS type #35 basic.	R58, R59: Deviation meter calibration adjustment for bands A and B. R69: R-f meter calibrating adjustment resistor.	3Z7410–212
R60, R61, R62	RESISTOR, variable: WW; 20,000 ohms ±10%; ½ w; CTS type #35 basic.	R60, R61, R62: Deviation meter calibration adjustment for bands C, D and E.	3Z7420–124
R91	RESISTOR, variable: WW; 10,000 ohms ±10%; 2 w; CTS type #252 basic, per A. R. F. Products, Inc. part/dwg #193A11580.	IF LEVEL resistor	3Z7410–213
R23	RESISTOR, variable: WW; 10,000 ohms ±10%; 2 w; CTS type #252 basic, per A. R. F. Products, Inc. part/dwg 193 X 11581.	Grid bias resistor for modulator tube V5.	3Z7410–214
R57	RESISTOR, variable: 25,000 ohms ±10%; ½ w; CTS type #35 basic.	Calibrating resistor M2	3Z7425–116
RT1	RESISTOR, thermal: amperite 9–4, T9 bulb, 4 11/16 in. lg o/a, 7 w.	Provides V5 and V6 filament voltage regulation.	
R70, R49	RESISTOR, variable: 100,000 ohms ±10%; ½ w; CTS type #35 basic.	R70: I-f output meter calibrating resistor. R49: Plate loading for V8.	3Z7480–214
E8, E9, E11 through E16, E18 through E20.	SHIELD, electron tube: 1¾ in. lg, .810 in. ID; JAN type TS102U02.	E8: Tube shield for electron tube V1. E9: Tube shield for electron tube V2. E11: Tube shield for electron tube V4. E12: Tube shield for electron tube V5. E13: Tube shield for electron tube V6. E14: Tube shield for electron tube V7. E15: Tube shield for electron tube V8. E16: Tube shield for electron tube V9. E18: Tube shield for electron tube V12. E19: Tube shield for electron tube V13. E20: Tube shield for electron tube V14.	2Z8308–276
E3	SHIELD, electron tube: 1 15/16 in. lg, .950 in. ID; JAN type TS103U02.	Tube shield for V3	2Z8304.183
E11	SHIELD, electron tube: 2¼ in. lg, .930 in. OD; JAN type TS102U03.	Tube shield for V11	2Z8304.172
	SHUTTER, dial: aluminum 24S–T3 dull black anodized: 5⅞ in. dia. 1/32 in. thk; marked band designations A, B, C, D, and E and corresponding freq ranges in mc; A. R. F. Products, Inc. part/dwg #220B12169.	Designed to cover unused portion of main dial scale.	2Z8278–1
X15	SOCKET, crystal: ⅞ in. lg x ⅜ in. wd x 3/32 in. h; EBY part #9006.	Socket for crystal Y10	2Z8761–60

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
XV1, XV2, XV4, XV7 through XV9, XV11 through XV14.	SOCKET, electron tube: miniature size; JAN type TS102P01.	XV1: Socket for V1 XV2: Socket for V2. XV4: Socket for V4. XV7: Socket for V7. XV8: Socket for V8. XV9: Socket for V9. XV11: Socket for V11. XV12: Socket for V12. XV13: Socket for V13. XV14: Socket for V14.	2Z8677.171
XV3	SOCKET, electron tube: jumbo miniature; JAN type TS103P01.	Socket for V3	2Z8679.30
XV5, XV6	SOCKET, electron tube: miniature size; JAN type TS102C01.	XV5: Socket for V5 XV6: Socket for V6.	2Z8677.99
XV10, XC6, XC37.	SOCKET, electron tubes: medium octal size; JAN type TS101C01.	XV10: Socket for tube M10 XC6: Socket for C6. XC37: Socket for C37.	2Z8678.327
	SPRING: 3/8 in. lg, 3/16 in. OD; A. R. F. Products, Inc. part/dwg #208A11527.	Provides spring force for spur and rack gear assembly in r-f attenuator plunger drive.	2Z8877.756
	SPRING, helical torsion: 2 1/32 in. lg x 5/8 in. wd x 9/64 in. h; A. R. F. Products, Inc. part/dwg #208A11984.	Holds lever arm against the cam of main dial.	2Z8877.757
	SPRING, helical compression: 1 3/16 in. lg x 5/16 in. wd x 2 9/64 in. h; A. R. F. Products, Inc. part/dwg #208A12219.	Holds center part of coupling in position.	2Z8877.758
	SPRING, helical compression: 9/16 in. x 7/64 in. ID; A. R. F. Products, Inc. part/dwg #208A12673.	Maintains tension on special attenuator switch.	2Z8877.784
	SPRING:,1¾ in. lg x 7/8 in. wd x .010 in. thk; A. R. F. Products, Inc. part/dwg #208A-11725.	Provides pressure on crystal turret detent arm for positive location.	2Z8877.759
S5	SWITCH, . push: DPDT; normally open; 1 13/32 in. lg x 1 in. wd x .312 in. h; A. R. F. Products, Inc. part/dwg #212A11622.	Connects 1-volt position in i-f attenuator.	3Z9824–20
S3	SWITCH, rotary: one sect.; 3 positions; 3 poles. one throw; 9/16 in. lg excluding bracket and shaft x 1 3/8 in. wd x 1½ in. h; A. R. F. Products, Inc. part/dwg #212A11627.	DEVIATION RANGE switch	3Z9825–110.3
S2	SWITCH, rotary: wafer; 1 sect.; 6 positions; 1 9/16 in. lg x 1 7/16 in. wd x 3/16 in. thk; A. R. F. Products, Inc. part/dwg #212A11985.	Individual bar deviation correction switch.	3Z9825–110.4
S1	SWITCH, rotary: wafer; 4 sect.; 6 positions; 1½ in. lg x 1 3/8 in. wd x 2 3/8 in. thk; A. R. F. Products, Inc. part/dwg #212A11547.	OPERATION switch	3Z9825–110.5
S8A, S8B	SWITCH, rotary: wafer; 1 sect.; 11 positions; 1 7/8 in. lg x 1 5/8 in. wd x 5/8 in. h; shorting type contacts; A. R. F. Products, Inc. part/dwg #212A11503.	I-f circuit switch	3Z9825–110.6
S8C	SWITCH, rotary: wafers; 1 sect.; 12 positions, 1 7/8 in. lg x 1 5/8 in. wd x 7/16 in h; Oak Mfg Co, per A. R. F. Products, Inc. part/dwg #212A11504.	I-f circuit switch	3Z9825–110.7
S6	SWITCH, toggle: DPDT; 30 amp, 250 v a-c; JAN type ST52N.	POWER ON-OFF switch	3Z9863–52N
S7	SWITCH, toggle: 4PDT; 20 amp, 125 v a-c; CH type #7665–K3.	Power, 119 to 230 volts	3Z9849.218

2. Identification Table of Parts for Signal Generator SG–12/U—Continued

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
T2	TRANSFORMER, power, step-down and step-up: 115 or 230 v a-c, 50–1000 cyc; 3 output wdg—No. 1 secd 600 v, .1 amp d-c; No. 2 secd 13 v, 5 amp, tapped at 6.3 v; No. 3 secd 5 v, 2 amp; A. R. F. Products, Inc. part/dwg #234A531.	Plate and filament supply	2Z9621–435
T1	TRANSFORMER, AF: 50,000 ohms pri, 12 ohms secd; ±2 db from 500 to 2000 cps; A. R. F. Products, Inc. part/dwg #234A11532.	Speaker output transformer	2Z9632.669
M1	VOLTMETER: panel mtd; dc; marked I. F. MICROVOLTS 0–1.1 cw, graduated in increments of 1/10, marked RF SET TO LINE; ±5% accuracy at full scale reading; 33,333 ohms per v; 30 μa required for full scale deflection; A. R. F. Products, Inc. part/dwg #150B11625.	To read the output voltage of r-f power.	3F7941A1

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[AG 412.41 (15 Sep 53)]

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